ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

L. W. W. MORROW, *Editor*

ALLEN M. PERRY
Managing Editor

A. E. KNOWLTON
Associate Editor

E. R. SEARLES
News Editor

G. F. WITTIG
Statistical Editor

EARL WHITEHORNE
Contributing Editor

JAMES H. RUDD
Publishing Director

FRANK R. INNES
Western Editor
520 N. Michigan Ave.
Chicago

C. W. LEIHY
Pacific Coast Editor
883 Mission St.
San Francisco

H. S. KNOWLTON
Contributing Editor
1127 Statler Bldg.
Boston

PAUL WOOTON
Washington
Correspondent
National Press Building
Washington

What in the World!

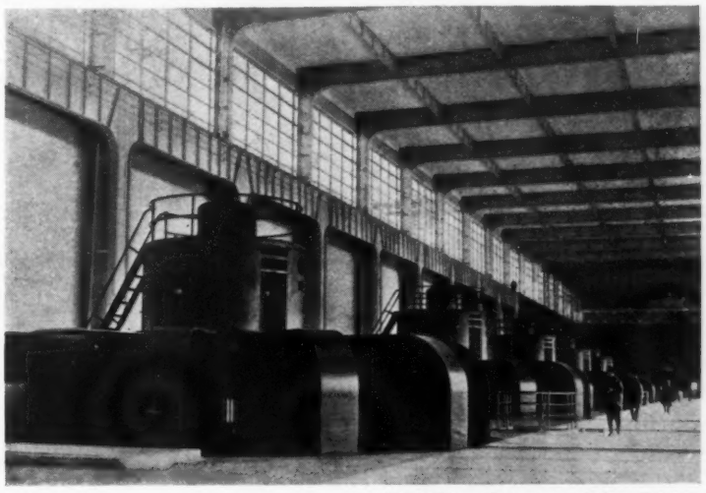
"You will get into plenty of hot water if you discuss the jobber," other friends in the industry told us. Perhaps that is only the best of evidence that his situation needs discussion so that constructive thought and action may develop. Distribution is too complex a theme to permit of grand generalizations. National associations can and should get together in each field—manufacturer, wholesaler, dealer and contractor—and state principles. It is then up to each local trading area to carry out these principles in terms of practical business conduct. The trouble is that today facts are missing and it is only upon tangible evidence that helpful conclusions may be drawn (page 798).

•

To make electrical service and the use of electrical appliances safer and more satisfactory is the continuous aim of the industry. But what physiological values and reactions are involved and to what limits should designers work? Gordon Thompson of the Electrical Testing Laboratories has tried to find out. Among other things he concludes, after examining no less than 70 subjects in experimentation, that the most sensitive person requires 600,000 ohms for safeguard against 120 volts. In other words, limit leakage currents to 0.2 milliamperes (page 793).

•

On second thought, we still think the Century of Progress to be a great and inspiring show. We are increasingly hopeful of the future of the Edison Electric Institute. Those who visited Chicago last week came away with a spirit of optimism and courage that was less noticeable when they arrived. Perhaps next year will see us back once more in the familiar surroundings of Atlantic City.



387,500-kva. Dnieproges station, U.S.S.R.

JUNE 17, 1933

Contents, Copyrighted, 1933, by McGraw-Hill Publishing Company, Inc.
VOLUME 101 . . . NUMBER 24

Fundamentals in System Planning 788
By W. J. LYMAN, *Duquesne Light Company*

Appliance Insulation Resistance 793
By GORDON THOMPSON, *Electrical Testing Laboratories*

Electric-Furnace Cast Iron 796
By H. J. HALL, *Detroit Edison Company*

Wholesaling for Profits 798
By L. W. W. MORROW, *Editor "Electrical World"*

Regulation of Rural Feeders 802
By H. B. PHELPS, *New York Power & Light Corporation*

Improving Small Hydro 805
By L. M. ROBERTSON, *Public Service Company of Colorado*

News of the Industry 777
Favors Electric Heat for Fusing Caustic 792
Metallized Radio Tubes 792
Big Losses in Furnace Electrode Joints and Clamps 801
Protection of Idle Machines 804
Inexpensive By-Pass Facilitates Outdoor Switch Inspection 804
Men of the Industry 807
New Equipment Available 808

Electrical World articles are indexed in Industrial Arts and Engineering indexes, available in public libraries

Published weekly. $5 per year. 25 cents per copy. Central and South American countries, $7. Foreign, $9 U. S. currency, or 45 shillings per year. Canada subscription price (including Canadian duty), $7.50. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Cable Address MCGRAWHILL, N. Y. Member A.B.P. Member A.B.C. Number of copies printed in this issue, 12,850.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President; Harold W. McGraw, Vice-President; B. R. Putnam, Secretary.

The Wire HOSKINS CHROMEL (CHROMIUM-NICKEL) that lasts longer

It sounds almost unbelievable, but it's a fact, that—when Chromel was developed in 1906, it proved to last, as a heating-element, more than 300 times longer than any other resistor then available. It is that fact which created the electric heating industry and your heating load. And Chromel is still more durable now—much more. Thus, heating devices today are better than ever before, when they are Chromel equipped. And this is why almost all electric ranges, where heating unit service is most severe, have Chromel units.

The alloy is melted at our plant in high-frequency induction furnaces which produce a swirling action of the metal, assuring uniform alloying action; the melting is also very fast which minimizes metal losses and thus gives almost laboratory accuracy in the control of the composition. You can, with confidence, recommend Chromel for heating-elements. Send for our new Catalog-IW, and Heating-Unit Calculator. Hoskins Manufacturing Company, Detroit, Michigan.

THE WIRE THAT MADE ELECTRIC HEAT POSSIBLE

ELECTRICAL WORLD

Established 1883. Mc Graw-Hill Publishing Company, Inc.

for the Week Ending

June 17, 1933

Energy Tax Shift Finally Passes

LACKING only the signature of President Roosevelt before becoming a law, the federal tax measure which shifts the 3 per cent electrical energy tax and also continues the one-cent gasoline tax and permits postal rate changes from 3 to 2 cents has passed the Senate and House of Representatives after a stormy career and much alteration (ELECTRICAL WORLD, June 10, page 737).

As finally passed the energy tax upon domestic and commercial consumption of electrical energy now paid by the consumer will become a levy upon the utilities. Exemption is provided for municipal plants, an amendment which delayed the bill and upon which the Senate, under the leadership of Senators Norris, Bone and Johnson, insisted. The change will be effective September 1 of this year.

▼

Anti-Merchandising Law Not Valid, Says Kansas Court

Holding the Kansas anti-merchandising law limiting utility appliance sales and activities to be unconstitutional, the Kansas Supreme Court last week indicated that in its opinion the measure was discriminatory against utilities and that the sale of appliances was the right of utilities under their franchise to promote and further their business.

Anti-merchandising measures have long caused dissension in various communities. Cities Service fought the Kansas law in defense of what it esteemed its rights and privileges. A similar decision was rendered by the state Appellate Court in Texas this week in the case of the San Antonio Public Service Company (page 783).

▼

84 Kw. per Sq. Ft. of Floor Space

Not only is the 1,200-lb. pressure steam turbine at the Ford Motor Company's River Rouge plant the largest to have been installed in any industrial power house but it is the largest high-pressure unit to have been installed anywhere, according to General Electric engineers. The turbine-generator unit is of 110,000 kw. capacity and occupies the space formerly required by a machine of but one-ninth the capacity. This turbine is of the vertical-compound type. Its development of 84 kw. per square foot of floor space is said to be a record.

▼

Boulder Dam Line Contract Awarded; Work Starts

Following close upon the news that by order of the California Supreme Court the Los Angeles Bureau of Power and Light must enter into formal contract for a Reconstruction Finance Corporation loan to finance the Boulder Dam power transmission line (ELECTRICAL WORLD, June 10, page 744) comes word that the contract for the cable has been awarded and three construction camps are to open soon.

The 271-mile line will be of two-circuit construction with three conductors apiece. The cable will be of copper, 1¼ in. in diameter, and of the Heddernheim single-layer, hollow-core type. This is said to be the first large undertaking in the country to have adopted that form of transmission conductor. Contract went to the General Cable Corporation for $2,399,000. Competitive bids were: $2,600,000, Phelps Dodge, and $2,750,000, Anaconda; a low bid of $2,750,000 by the Aluminum Company for aluminum cables was reported rejected.

According to Dwight E. G. Palmer, vice-president, General Cable will erect a Los Angeles plant for the manufacture of these cables. He stated that this would be made a permanent plant. Deliveries are to begin January 1 to be completed in one year.

Erection of three camps in the desert by the Bureau of Power and Light, each to accommodate 150 to 200 men, is now under way to speed the preliminaries on this $22,800,000 project.

▼

French Power Project Impounds 22-Mile Lake

Inauguration of operation of what is said to be the largest dam in western Europe, that at Sarrans, France, across the Truyère River, was accomplished this week in the presence of President Lebrun. The dam is 315 ft. high, 660 ft. wide and spans a canyon 450 ft. deep. An artificial lake 22 miles long has been created as part of the project.

This development includes the Brommat power plant, one of the most interesting undertakings ever attempted, as it involves a subterranean hydro-electric station of 195,000 kw. capacity which was built in the solid rock many feet underground (ELECTRICAL WORLD, August 27, 1932, page 265).

Development of the Truyère involves some 315,000 kw. and is part of a comprehensive power scheme of the republic (ELECTRICAL WORLD, April 16, 1932, page 677).

▼

Welding of Small Vessels

Of 51 vessels constructed in 1932 by the Ingalls Iron Works of Decatur and Mobile, Ala., 48 were arc welded. Six welded barges are now under construction. In the process used (shielded arc type) all joints are butt welded, with no holes punched for bolts or rivets, making the welded joints stronger than the parent metal and the vessel when completed practically a solid piece of metal from stem to stern.

Industry Recovery Bill Passes

THOUGH rebellious and reluctant to adjourn, Congress approved the industry recovery bill in substantially the form in which it was originally submitted for action. With President Roosevelt's signature it becomes the new guide to competition, prices, wages, working hours, production volume, trade association activities and public works on a hitherto unknown scale.

As finally passed by both houses the measure gives to President Roosevelt virtually unlimited power to foster and insist upon intra-industry co-ordination to the end of providing jobs for thousands now idle and to revive the pace of all industry. Codes of fair competition to be accepted voluntarily by business are provided for. Power of enforcement through licensing provisions and penalties lend teeth to preclude violations.

Tax changes included

Authorization of a $3,300,000,000 bond issue to finance construction of federal, state, local and public-benefiting private projects, requiring $220,000,000 annually to carry, is given. For this new taxes are provided as follows:

A tax of one-tenth of 1 per cent on corporation net worth, with a 5 per cent additional assessment on earnings above 12½ per cent; a 5 per cent tax on corporation dividends to be deducted at the source; an increase of one-half cent in the present gasoline tax; three-year extension of corporation-consolidation-return authority with increase of 1 per cent in income tax rate on consolidated returns, instead of the present three-quarters of 1 per cent.

Extension is allowed for one year of all special excise taxes voted by the last Congress. Administration of the income tax law will be altered to prevent carrying over into subsequent years stock and bond losses which exceed the gains in the year in which they occur. These apply to both corporations and individuals.

The public works program is authorized to include:

Construction, repair and improvement of public highways and parkways, public buildings, conservation and development of natural resources, prevention of soil or coastal erosion, development of water power and transmission of electrical energy, river and harbor improvement and flood control. Low-cost housing and slum-clearance projects, dry-docks, naval vessels permitted under the London Treaty, heavier-than-air craft and technical construction for the army air corps.

The Public Works Administrator is empowered to make grants to states and municipalities for construction and improvement projects up to 30 per cent of the cost of labor and materials.

The President is authorized to institute proceedings before the Tariff Commission and to embargo or limit imports where they interfere with the purposes of the act in raising wages and prices.

There is also authorized $100,000,000 for distribution by farm-relief administrators.

The Borah amendment seeking to negate the anti-trust law freedom which the bill grants was not included in its original form. Anti-trust restrictions are presumably to be raised.

▼

Roosevelt Indorses St. Lawrence Treaty

In a letter to Senator La Follette, made public last week, President Roosevelt expressed his support of the St. Lawrence resolution passed by the House which would award all power rights to New York State in exchange for expenditure by that state of an estimated $89,000,000 to pay the United States' share of the cost of the power project in connection with the waterway. It was Senator La Follette who introduced the power resolution as an amendment to the industrial recovery bill (ELECTRICAL WORLD, June 10, page 743).

President Roosevelt said: "I do not hesitate to tell you—and I do so with complete consistency—that I favor the resolution relating to the St. Lawrence power development passed by the House. I also favor the ratification of the Great Lakes-St. Lawrence deep waterway treaty. The resolution means, in effect, that the Congress will see to it that the state of New York, in paying for the power part of the development, will pay only for that part and will thus be able to insure cheap electricity for the consuming public.

"The treaty itself has been indorsed by both major political parties. The beginning of the work of construction at an early date can be made an essential part of the national public works program and will furnish employment to thousands of people . . ."

The President's letter caused no evident change in the attitude of the Senate, which thus far has kept the treaty and the House resolution on the calendar without prospect of action at this session.

▼

Illinois City Reconsiders Municipal Plant Merits

O'Fallon Ill., after relinquishing its municipal plant ten years ago, and granting a franchise to the Illinois Power & Light Company which expires this July 1, is now seeking facts upon which to re-establish a city-owned project.

Some weeks ago the O'Fallon City Council requested Illinois Power & Light to reduce rates by 25 to 40 per cent, intimating that unless action resulted steps would be taken toward the municipal plant now discussed. The utility declined to meet the city's demands. Rates in O'Fallon are said to be 20 to 25 per cent higher than in nearby towns. The W. A. Fuller Company of St. Louis has been retained to make the survey for the city.

▼

Westinghouse Rushes Refrigerators

With the receipt of more orders for refrigerators in May than in any previous month of the company's history, R. C. Cosgrove, manager of the refrigeration department of the Westinghouse Electric & Manufacturing Company, has announced that the Mansfield, Ohio, works and the East Springfield, Mass., refrigeration division are now operating at capacity, 24 hours a day. In the first few days of June orders were being booked at the rate of 850 units a day. Approximately 400 more workers are now on the payroll of the Westinghouse Mansfield Works than were maintained during the war-time peak of employment in 1918, a situation due entirely to the necessity for electric refrigerator production. Mr. Cosgrove stated that increased production has been caused not by any unusually large single orders but, instead, from an abundance of small orders which shows a widespread buying trend from every part of the country.

▼

Washington Commissioner Outlines His Policies

Addressing the local section of the American Institute of Electrical Engineers at Tacoma, Wash., recently, E. K. Murray, director of the State Department of Public Works, declared "regulation is on trial at the present time, and if it fails in connection with public utilities, it will not mean the end of regulation, but it will mean public ownership."

Mr. Murray stated that his department obtained from the Legislature sufficient money and broad enough powers to give rigid regulation a fair trial. He also revealed the attitude which that state will take toward rate setting, wholesale contracts, merchandising, control of budgets, control of dividends on common stock, operation of holding companies, the disposition of excess earnings and the regulation of the sale of stocks and bonds.

"We are in a period of experimentation economically. Apparently the system we have contains serious defects and we must begin to build on a sounder basis and any changes will be reflected in utilities and the regulation thereof. I have no illusions about the code of ethics of the utilities. Under the one which they operate now they are far above the average business. If they

conducted themselves like some merchants or some bankers they would land in jail, but notwithstanding this, they are not outstanding examples of business rectitude. They follow what they think is good business. It would be good business to be more frank and fair than they are if they could only be made to see it."

In the case of utilities engaged in merchandising various commodities as a sales promotion plan, the director declared that they will be required to keep this phase of their business separate so that it will not figure in the setting of rates. The jurisdiction of the department over utility budgets will lead to a greater care in expenditures and the publicity will have a cleansing effect, he said. In speaking of holding companies, he said that the public would gain if they were done away with entirely.

Control will be exercised, he said, to see that dividends are from real surpluses and will not interfere with the company's ability to give service and that in the future companies will not build entire plants out of excess earnings as has been done in the past.

▼

Georgia Governor Cites Utility Commission in Order

All members of the Georgia Public Service Commission have been cited by Governor Talmadge to appear before him on June 26 and show cause why they should not be removed from office for alleged conspiracy with public utilities to build up monopolies in Georgia and charge exorbitant rates to consumers.

This action has been taken following a petition from the Georgia Federation of Labor, in which more than a dozen acts of alleged favoritism were charged to the commission. Among other things, the state Public Service Commission is charged with fixing a valuation on property of the Georgia Power Company amounting to $152,000,000 while allowing the corporation to make a return for taxation of only $45,000,000 and being "dominated and controlled" by the Georgia Power Company.

Numerous charges are made against the Georgia Power Company, also, in the petition for the removal of the Public Service Commission from office. The firm is charged with buying up competing companies at a fraction of their real value in order to create a monopoly; buying power from affiliated power companies at 4 cents a kilowatt-hour and selling it back at 2 cents in order to show losses in operating expenses; operating an electrical appliance business at a loss of $144,402 charged up to its consumers, and buying up all available hydro-electric power sites, in spite of the fact that it does not intend to develop them in the near future.

Members of the commission who will be removed, if Governor Talmadge finds them guilty of the charges brought against them, are James A. Perry of Atlanta, Perry Knight of Valdosta, Walter McDonald of Augusta, Albert J. Woodruff of Decatur and Jule Felton of Montezuma, Ga.

Commissioners reply

Replying to the charges of the petition, the commission in a signed statement said, in part:

"For several months in the recent past J. C. Savage, as attorney for certain labor groups who signs the petition to the Governor, has over the radio and through the press sought to discredit the work of the Georgia Public Service Commission.

"While the petition to the Governor apparently deals with all utilities, it deals in the main with the property of the Georgia Power Company. It will be recalled that some years ago a certain group of organized labor employed by the Georgia Power Company struck. Soon after this strike there were repeated blasts from dynamite resulting in much damage to the Georgia Power Company's property and great inconvenience to a large number of its customers. This continued for a long while until the daily press at Atlanta some months ago denounced it in no uncertain terms and called on the law-abiding citizens of the city and state to see that it was stopped. Since then there hasn't been a single charge of dynamite turned loose destroying property of this company. We merely call attention to these happenings without any charge, but leave the facts for deductions and conclusions by the general public.

"We have given the same rate as enjoyed by Atlanta to the smallest communities in the state of Georgia, wherever served by the Georgia Power Company, some of them approximately 300 miles distant from Atlanta. There is a feeling in Atlanta, perhaps by a limited few, that Atlanta should have a lower rate than other sections in Georgia. We have ignored this feeling, and will continue to do so."

▼

And Now—Work, Not Wail

As even the die-hards recognized to be inevitable, the industry recovery bill, virtually as submitted to Congress on behalf of the Administration, has passed. Such powers as have not been conferred on government since the advent of the industrial age are now legally available to work man-made miracles—$3,612,000,000 for public works and administration of the industry recovery act. Licenses for the right to conduct business. Hours and rates of pay to be dictated or approved. Those who fear the worst in this unprecedented situation may be right, but they overlook the fact that presumably every industry in America is in the same situation. All may sink or swim together. Industry need wait no longer. It is time to go out and SELL.

Nearer and nearer draws the test of program. Can the World Economic Conference survive the debt question? Can tariffs be juggled to make the American standard of living an exception to the rest of the world and still develop trade? Can government spending for unneeded facilities prove its ultimate economic justification? Can the Supreme Court relegate to limbo all the precedents of the past to permit and encourage policies of expediency? Who knows?——but it will not be long before we all find out.

So far as business news is concerned one may search in vain among the current barometers for storm signals. Car loadings rise to 58 per cent of a 1923-1931 = 100 base. Automobile and refrigerator production continue to rise. Steel output stands at the undreamed-of-a-few-months-ago figure of 46 per cent of capacity. Electric power output, cotton purchases by textile mills, lumber sales and general indexes tell the same story. Security markets and commodity prices swirl giddily.

Red Seal Values in Vancouver

Upon the basis of a survey just completed by the Electrical Service League of British Columbia it is concluded that the value of appliances installed in a Red Seal home is $726, compared with $260 in a non-Red Seal home. Through its Red Seal efforts the league has been responsible for creating $1,667,780 more appliance business than would have been obtained in the same number of non-Red Seal residences. In 1922 the average number of outlets in Vancouver homes was ten, representing a value to the industry of $25 per home. In 1932 the average was 57.6, with a value to the industry of $95.

▼

Interstate Compact for Bay State?

In a message sent to the Legislature last week Governor Ely of Massachusetts has urged that body to empower the Department of Public Utilities to negotiate in the state's name compacts with New York, Vermont, Connecticut, New Jersey and Pennsylvania or with any one or more states for the regulation of interstate transmission of gas and electricity on a basis of joint regulation and control of rates and charges. The Governor stated that any compact would be binding until approved by the Legislature. Representatives of several eastern states attended the conferences held this year on this problem of the regulation of interstate power (ELECTRICAL WORLD, February 11, page 181, and March 4, page 276).

Coming Meetings

American Foundrymen's Association — Chicago, Ill., June 19-24. C. E. Hoyt, 222 W. Adams St., Chicago.

American Physical Society — Chicago, Ill., June 19-24. W. L. Severinghaus, Columbia University, New York.

American Society of Agricultural Engineers—Rural electric sessions, Lafayette, Ind., June 22-23. T. E. Hienton, West Lafayette, Ind.

American Institute of Electrical Engineers—Summer convention, Chicago, Ill., June 26-30. H. H. Henline, 33 West 39th St., New York.

American Society of Mechanical Engineers—Chicago, Ill., June 26-30. C. W. Rice, 29 West 39th St., New York.

American Society for Testing Materials—Chicago, Ill., June 26-30. C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Engineers' Day, Century of Progress Exposition—Chicago, Ill., June 28, G. E. Pfisterer, 308 West Washington St., Chicago.

Illuminating Engineering Society—Delavan, Wis., August 28-31. D. W. Atwater, 29 West 39th St., New York.

International Association of Electrical Inspectors—Chicago, Ill., September 11-15. V. H. Tousley, 612 No. Michigan Avenue, Chicago.

▼

Illinois Power & Light Receivership Dismissed

Motion to dismiss the receivership suit brought against the Illinois Power & Light Corporation by E. J. Harvey, a bondholder (ELECTRICAL WORLD, June 3, page 710), has been approved by United States District Judge Walter C. Lindley. Mr. Harvey claimed in his bill that a surplus of more than $2,000,000 would have been converted to a deficit of $27,272,541 if the company had made proper charges for depreciation. Judge Lindley ruled that the bill was faulty, in that it only asked for appointment of receivers, and that the plaintiff did not show when he became a creditor of the defendant.

Directors of the corporation have voted to defer action on the $6 and 6 per cent preferred dividends due at this time. Regular payments in the past have been at the rate of $1.50 a share quarterly on both issues. In a letter to stockholders explaining the action, the company states that it was deemed necessary because market conditions have not permitted a refunding of its notes, which now total $2,550,000. In addition, a bond maturity amounting to $660,000 is due within six months and the company, in view of these facts, desires to conserve cash. The letter states that dividends have not been paid on the common stock for more than a year.

▼

May Industry Far Ahead of 1932

Greatly increased activity in almost every branch of manufacturing industry is indicated by the electrical energy consumption during May, thus far reported to the ELECTRICAL WORLD. Although returns are not yet sufficiently full to warrant computation of the ELECTRICAL WORLD index for the month, a preliminary estimate points to 93 or 94 as a quite possible value if later returns support those now in hand.

Since the index for April was about 83, and for both months last year about 82, this would signify a gain of 13 per cent over May, 1932, after an uninterrupted series of losses that continued for nearly four years and was not broken until last April.

▼

Canadian Results Reported in 32 Home-Heating Trials

To aid in the creation of additional income for utilities temporarily having excess power and to obtain a fairly definite idea of the rate which may be paid by moderately well-to-do householders for such use, complete electric heating of 32 Canadian homes was supplied on an experimental basis in the winter of 1932-33. The results, as reported to the Canadian Electrical Association at its meeting at Lucerne-in-Quebec this week, indicate tangible use factors, but omit conclusions as to the advisability of building such a load.

Actual results of the experiments showed that in the aggregate 68.5 per cent of the installation cost is earned the first year if surplus power used is not valued. The average return for energy used turned out to be 0.24 cent per kilowatt-hour. This figure was about 60 per cent of that expected from calculations involving the total amount of fuel reported, and assumed efficiencies of fuel heating. Based on these tests maximum demand per house averaged 25.54 kw. The average demand per house for the season was 10.31 kw. and for February was 14.15 kw. For these periods the average load factors were 43.5 and 58.5 per cent respectively. The total maximum demand was not measured, but is expected to approach the total connected demand on exceptionally cold, windy days, for the house temperatures were kept up to normal at such times. This is probably better service than had formerly been had with other fuels.

It was concluded that because of the cleanliness, comfort and convenience obtained by the users of these installations those who can afford a little additional expense would be willing to pay 0.5 cent per kilowatt-hour rather than dispense with the service after several years' enjoyment, particularly if the rate is raised gradually as they learn to effect greater economy in the use of electric heat, which is possible to a surprising degree in the average residence.

▼

City Faces Plant and Service Contracts

Frankfort N. Y., by action of two courts, is in the unusual position of having a contract with a manufacturer for the purchase of a Diesel engine station for a municipal power plant and at the same time a contract for street lighting service with the Utica Gas & Electric Company, both of which have been held valid. Failure to fulfill either obligation would probably lead to further litigation.

▼

Oil Burner Association Sees 7,000,000-Unit Market

This week the American Oil Burner Association held its annual convention in Chicago. It is estimated that the industry has already installed 1,000,000 units in the homes and small buildings of America, but the lure of 7,000,000 homes as yet unsold stands as an earnest of more and just as good business to come. In the first twelve years of its existence the burner industry has sold more units than the automobile industry did in its first twelve.

"The time is at hand," said Morgan J. Hammers, president of the association, "when the two allied industries should come to an understanding on a unified selling plan." He was speaking both as a burner manufacturer and as a petroleum executive. "If we are to go after the potential market of 7,000,000 homes, we must be able to make prices and terms to the public that will appeal to all income class levels. I think it can be done.

"In the electrical industry we have an outstanding instance of what is possible through co-operative means where two branches of an industry can come to agreement because of mutually advantageous goals. Certainly, had the power companies through their national associations failed to get behind the sale of refrigerators as a fine electric load builder, there never would have been anything like 1,000,000 refrigerators sold in a single year.

"Similarly, if refrigerator manufacturers had determined to play a lone hand in promoting their equipment they would today be a long way behind their present quotas."

▼

Utility Control Passes at Continental Auction

Probably the largest auction of securities to have taken place since 1929, the holdings of Continental Shares, Inc., pledged with the Chase National Bank, were this week auctioned to the highest bidder for slightly more than $23,240,000. The loan, which was originally $33,500,000, had been reduced to nearly $27,000,000 at the time of the auction.

Continental Shares, part of ambitious 1929 Cyrus S. Eaton plan to acquire control or power in various major industries, languished with succeeding stages of the depression. Included in its holdings at the time of the auction were

the following utility securities: 448,667 shares of United Light & Power B, 40,000 shares of International Power & Paper A, 170,000 shares of International Power & Paper B and 300,000 shares of International Power & Paper C. All of these blocks were bought in by the Chase Bank. Sale of 350,000 shares of Lehigh Coal & Navigation, representing virtually working control of an organization which in turn holds about 12 per cent of the stock of the National Power & Light Corporation, was also involved.

Control of the Kansas City Power & Light Company passed also in this auction, for 525,000 shares of the Kansas City utility's common stock are owned by Continental Gas & Electric Company, 99 per cent of whose stock is owned by United Light & Railways Company and which in turn is controlled by United Light & Power Company. It is the stock of the latter which was relinquished at the auction by Continental Shares, Inc.

▼

Middle West Agreement Sanctioned by Court

Approval of the recent agreement between Chicago bankers and committees representing bondholders and stockholders of the Middle West Utilities Company, whereby certain obligations of the company were to be remitted and a portion of collateral deposited to secure loans returned to the company (ELECTRICAL WORLD, May 27, page 660), has been given by Federal Judge Walter C. Lindley. This action paves the way for a possible reorganization of the company and the averting of bankruptcy proceedings.

Charges of dishonesty against Samuel Insull and his brother, Martin, were brought last week by the receivers for the Middle West Utilities Company, Edward N. Hurley and Charles A. McCulloch. They filed suit in federal court against the New Amsterdam Casualty Company of New York to recover $100,000 on a brokers' blanket bond protecting the utility company against dishonest acts of employees. The Insulls were accused in the suit of defalcations amounting to almost $7,000,000. It was indicated that the receivers will soon file a similar suit against another casualty company on a $200,000 bond. The suit mentioned ten specific "felonious acts." The charge against Samuel Insull says "that on July 7, 1931, Insull, chairman of the board of the Middle West Utilities Company, misappropriated $750,000 in funds of the company, which were paid on his order to the Public Service Investment Company (an Insull subsidiary) with directions that the money be paid to Earle H. Reynolds, president of the People's Trust & Savings Bank."

Security Market Continues Rise

Shaking out the-for-a-while-courageous bears, security markets have advanced to new highs, taking commodity prices with them. Exceedingly unbalanced and riding for a fall, say the more cautious observers, but conservative speculators are rare specimens. "Electrical World" stock average 35.0 this week; 31.1 last.

▼

Trade Commission Examines Utilities Power & Light

Affairs of the Utilities Power & Light Corporation, which controlled electric and gas companies in numerous states and had an investment in subsidiaries at the end of 1930 totaling more than $76,000,000, were investigated last week at hearings before the Federal Trade Commission. H. O. Day, accountant for the commission, in reviewing the history and financial operations of the corporation, testified that total dividends paid by the corporation during the period 1915-30 were $22,312,222, of which $6,099,077 was cash and $16,303,-144 stock. Annual surpluses of the company ranged from a deficit of $362,-837 in 1922 to a maximum of $7,334,945. An increase in the surplus from $1,236,-948 in 1928 to $6,337,076 in 1929 was ascribed to increment in subsidiary companies, which was included for the first time in 1929.

For the period 1915-30 the return on investment for the corporation, based on income plus surplus adjustments, was 7.86 per cent on the total investment and 9.97 per cent on the common stock equity, before deducting appreciation. After deducting appreciation, the returns were, respectively, 8.68 and 12.44 per cent. Net income of the corporation ranged from a deficit of $143,410 in 1922 to a maximum of $4,926,117 in 1930. The total net income for the 1915-30 period was $15,734,575.

The examiner found that items of appreciation chiefly from appraisals had been added to investments and credited to surplus in the company's accounts in various instances, the total of such appreciation on December 31, 1930, being $4,902,291.

Niagara Lockport examined

In a subsequent hearing on the capital structure of the Niagara, Lockport & Ontario Power Company the Federal Trade Commission was informed by Kenneth A. Miller, its examiner, that at the instance of the Public Service Commission of New York State the company wrote off $1,500,000 of its intangible capital between 1912 and 1929. The report of the examiner covered the period from the formation of the company in 1894 until December 31, 1931, including the consolidation of the original company with the Western New York Utilities Company, Inc., in January, 1928, and the merging of eleven companies into the Niagara, Lockport & Ontario Power Company during the period 1918-27.

From July 1, 1916, to July 31, 1929, Mr. Miller said management and supervision services were rendered for the company by the Buffalo, Niagara & Eastern Power Corporation. "For these services, which included the payment of the salaries of the executive," the examiner reported, "Niagara, Lockport & Ontario paid a fee equal to 5 per cent of the gross operating revenues. The total fees paid during the period amounted to $1,403,328." The practice of charging management fees, however, was abolished when control of Buffalo, Niagara & Eastern Power was acquired by the Niagara Hudson Power Corporation in 1929.

Week's Output Largest of Year

Totaling 1,541,713,000 kw.-hr., according to the Edison Electric Institute, the output of central electric light and power plants during the week ended June 10 exceeded last year's for the corresponding week by 7.4 per cent. Thus for the sixth consecutive time operations surpassed those of 1932, and by a steadily widening margin.

The latest figure is also the largest thus far reported in 1933; it is more than 40,000,000 kw.-hr. greater than the previous maximum, in January, when the lighting load was still near its winter peak.

New England and the Central industrial region increased their previous percentages over 1932. The South decreased, but its gain is still 10.9 per cent. Only the Pacific Coast is under last year's output.

Weekly Output, Millions of Kw.-Hr.

Week ended	1933	1932	1931	1930
June 10	1,542	1,435	1,621	1,707
June 3	1,461	1,381	1,594	1,657
May 27	1,494	1,425	1,602	1,660
May 20	1,483	1,436	1,645	1,723
May 13	1,468	1,437	1,654	1,717

Per Cent Change from Previous Year

Region	Week Ended June 10	June 3	May 27
New England alone	+14.5	+12.1	+11.2
Middle Atlantic	+ 7.2	+ 7.1	+ 4.3
Central industrial	+10.0	+ 7.3	+ 5.4
Southern States	+10.9	+12.9	+15.8
Pacific Coast	— 5.3	— 2.3	— 7.3
United States	+ 7.4	+ 5.8	+ 4.8

▼

Federal Aid Sought for Oklahoma Project

With the purpose of obtaining a portion of the $3,300,000,000 public works fund appropriated by the President and Congress to aid industry and increase employment, the House of Representatives of the state of Oklahoma has introduced a resolution calling the attention of the federal administration to the need of flood control and work looking toward the navigation of the Arkansas River and the opportunities afforded for profitable work in the field of flood control, navigation and power. The Arkansas River Basin, more than 1,400 miles in length, drains a watershed in portions of seven states, Colorado, New Mexico, Texas, Kansas, Oklahoma, Missouri and Arkansas. It is a potentially navigable stream from Tulsa, Okla., to its mouth and its floodwaters and those of its tributaries contribute more to flood damage in the lower section of the Mississippi River than does the floodwater of any other Mississippi River tributary.

The resolution says in part: "In the work of reservoirs, irrigation, canals, levies, revetments, stream control, flood control, navigation, power plants, protection of soil from erosion and reforestation, the Arkansas River Basin presents a sound program of development unequaled nation-wide, and it is not too much to say that an excess of one-half million men can be employed immediately on these various activities."

▼

Funds Authorized for Cove Creek

Outline of the extent of the Cove Creek Dam project, approximately 200 miles above Muscle Shoals (ELECTRICAL WORLD, June 10, page 737), was indicated by Dr. Arthur E. Morgan, chairman of the Tennessee Valley Authority, after President Roosevelt had signed two executive orders, one authorizing the Tennessee Valley Authority to supervise construction of the dam and the other vesting that authority with power to undertake the supplementary work of instruction of employees.

The purpose of the dam, which will cost $34,000,000, is to assure an uninterrupted flow of water in the Tennessee River for the operation of the power plants at Muscle Shoals. From 500 to 1,000 workers will be employed on the dam for about four years. In the workers' leisure time they will be given instruction in sanitation, various manual trades and in general repair and construction work. The expense of such training, Dr. Morgan said, will be offset by the fact that the instruction given will tend to prevent a heavy turnover in labor at frequent intervals.

▼

Italy's Electrical Output Analyzed in Survey

Following announcement that a further extension of the electrification of Italian railways impends, the government has indicated that a loan of 600,000,000 lire will be floated to accomplish this expansion (ELECTRICAL WORLD, June 10, page 740).

The government also reports the following use of electrical energy at present:

Industry	Number of Users	Electricity Consumed Yearly. Millions of Kw.-hr.	Percent of Total Consumption
Public lighting	7,874	208	2.5
Private lighting	5,297,707	684	8.2
Applications in private apartments and public coffee houses, etc	139,610	181	2.1
Clothing	3,829	39	0.4
Food stuff	38,878	560	6.7
Paper	423	314	3.7
Printing	2,596	21	0.2
Textile	4,246	926	11.1
Common services	7,075	153	1.8
Mining	1,177	83	1.0
Various	89,109	267	3.2
Pottery and glass	778	43	0.5
Building	4,014	249	2.9
Chemical	1,953	284	3.4
Metal	1,333	436	5.2
Mechanical	18,081	505	6.0
Electro-chemical	472	2,287	27.4
Lumber	17,162	75	0.9
Agriculture	32,154	108	1.3
Industrial heating	6,739	99	1.1
Traction	350	803	9.63
		8,335	100

As can be seen, the most important consumer of electricity in Italy is represented by the electrochemical industries, followed by the textile and traction industries. Of the 803,000,000 kw.-hr. consumed at present in Italy for traction purposes 366,000,000 kw.-hr. is consumed by the Italian State Railways administration, while 437,000,000 kw.-hr. is consumed by privately owned railways, tramways, highways, etc.

Output of electricity during the first quarter of 1933 has increased, reaching 2,583,000,000 kw.-hr., against 2,396,000,000 kw.-hr. during the corresponding period of 1932. The increase is due above all to the progress in the output of hydro-electric power, which increased from 2,275,000,000 kw.-hr. in the first quarter of 1932 to 2,457,000,000 kw.-hr. in 1933.

The electric industries have asked from the Italian government further assistance with the view of obtaining a reduction in the taxes which are collected at present on the consumption of electricity for lighting purposes, and which prevent the Italian electric industries to offer the consumer an identical tariff for lighting and for power.

Texas Court Dissolves Anti-Merchandising Order

An injunction, granted some time ago by the district court at Austin, Texas, restraining the San Antonio Public Service Company from purchasing and selling electric and gas appliances and operating buses under certain conditions has been dissolved by the state Appellate Court. This case has aroused considerable interest in that it involved the right of utilities to engage in business not directly connected with their primary purposes.

"The law is settled that the powers of a corporation organized under general laws are not determined alone from its charter provisions, but also are determined from the law under which it is organized or operated," it was held. "It is also a settled law that it is not necessary for the charter of a corporation to contain all the powers conferred by statute, nor is it necessary to amend the charter of a corporation to include powers conferred solely by statute, unless the act itself requires the amendment."

Appliances sales proper

The judgment of the District Court was reversed in everything except an injunction restraining the company from maintaining an appliance-selling business at Seguin, which was affirmed. All contentions made by the Public Service Company in its appeal were practically sustained. The company does not sell electricity to the public at Seguin. It merely sells, when needed, power to be distributed through the municipality's system to city customers.

"We have reached the conclusion that under the facts and rules of law applicable, the appellant had the right, except as to its appliance business at Seguin, to engage in the purchase for sale and the sale of gas and electric appliances in connection with and as being incident to its principal business of manufacturing, supplying and selling gas and electricity to the public for heating, lighting and power purposes," the opinion held.

The suit was brought by Attorney-General James V. Allred to enjoin the Public Service Company from doing certain acts alleged to be in violation of law and of its corporate powers. After the filing of the suit, the company ceased selling gas and electric appliances in San Antonio, giving as its reason that the local merchants were rendering sufficient service to its gas and electricity customers with respect to appliances. However, the company continued to use space in its main office for demonstrating and displaying for various merchants all kinds of gas and electric appliances, and paid salesmen to induce its customers to purchase such appliances from the merchants selling them.

▼

Washing Machine Makers Confer on Recovery Plans

Ending of irregular trade practices, improvement of employment conditions and disappearance from the market of the lowest-priced household washers, together with a general upward trend of washer prices, are among the constructive results expected from a special conference in Chicago last week of the American Washing Machine Manufacturers' Association.

Washer makers representing 97 per cent of the country's production and parts and materials manufacturers in related lines approved the outline of a new code of trade practices designed to support President Roosevelt's industrial recovery act.

It was agreed that washer prices are very likely to move upward in the near future, for two reasons: One is that the federal government, in requiring industries to adopt uniform cost-accounting systems, will quickly reveal where manufacturing has been done at a loss, and the other is that materials and parts prices are steadily advancing. Final draft of a code is to be presented by a committee before a resumption of this meeting.

Another committee is compiling information on the industry's wage scale and production costs, in accordance with Washington's recommendations, designed to improve labor conditions and to end the making of non-profit items.

▼

Delinquent Electrical Accounts

(National Electrical Credit Association)

Number of Accounts Reported

Division	May 1932	May 1933	Per Cent Inc. or Dec.	Five Months 1932	Five Months 1933	Per Cent Inc. or Dec.
New York	252	166	—34.1	1.187	846	—28.7
Middle and Southern Atlantic	94	56	—40.4	562	316	—43.8
New England	94	50	—46.8	574	331	—42.3
Central	424	379	—10.6	2.574	1.478	—42.6
Total	864	651	—24.7	4.897	2.971	—39.3
Total Amounts Reported						
New York	$25.148	$12.998	—48.3	$122.297	$56.793	—53.6
Middle and Southern Atlantic	11.510	2.489	—78.4	53.339	17.740	—66.7
New England	6.643	3.284	—50.6	43.327	20.603	—52.4
Central	33.492	15.897	—52.5	199.450	86.632	—56.6
Total	$76.793	$34.668	—54.9	$418.413	$181.768	—56.6

Major New Construction This Week

Heavy-duty motors, transformers, pumping machinery, compressors, etc., will be installed for refinery at Texas City, Tex., by Pan-American Petroleum & Transport Company, New York. Site of 260 acres of land purchased. A $7,500,000 project.

Leisy Brewing Company, Cleveland, Ohio, care of G. A. Mueller, Detroit, Mich., architect plans $500,000 development.

Sheffield, Ala., has authorized bond issue of $150,000 for city-owned electric light and power plant.

Consolidated Water Power & Paper Company and Wisconsin Valley Improvement Company jointly plan hydro-electric plant on Wisconsin River, near Knowlton, Wis., in connection with water and water storage development. Estimated cost $5,012,000, of which about $1,645,000 will be used for power plant, transmission lines, substations, etc.

Samarkand Brewing Company plans San Francisco, Calif., plant. Cost about $250,000.

Burlington, Kan., has authorized bond issue of $118,000 for city-owned power plant, cost $85,000. Electrical distribution system to cost $33,000.

Milwaukee Brewing Company, San Francisco, Calif., plans to double capacity, at cost of $100,000.

Motors, conveyors, etc., will be installed in cigar and tobacco plant of John H. Swisher & Son, Inc., Jacksonville, Fla. Cost $100,000.

Portland Municipal Plan Killed

By a negative vote of the Mayor of Portland, Ore., a proposal before the City Council to submit to the voters a municipal power system scheme was killed. The measure, which would have been voted on at the special election July 21, would have authorized expenditure of $15,000 to prepare data looking toward the construction of a power plant at the city's Bear Creek dam. It was proposed that on the bases of the $15,000 study of this site the city might later seek a $3,000,000 federal loan to complete the first unit of the proposed system. The Mayor objected to the proposal on the grounds that it was not completely worked out and that before such a proposal should be placed before the voters it should be definitely outlined as to cost and purpose.

▼

New York Metal Prices

	June 6, 1933 Cents per Pound	June 13, 1933 Cents per Pound
Copper, electrolytic	8.00	8.00
Lead, Am. S. & R. price	4.10	4.20
Antimony	6.35	6.50
Nickel ingot	35.00	35.00
Zinc, spot	4.65	4.65
Tin, Straits	41.10	45.25
Aluminum, 99 per cent	23.30	23.30

Swansea to Be 240,000-Kw. Station

To replace the existing Swansea station of the British Central Electricity Board a new plant of 240,000 kw. rating is planned. The estimated cost, as sanctioned by the British Electricity Commission, is $6,956,800. The state grants provide for the whole of the interest charges up to December, 1934, and half the interest from that date until March, 1945. Tunnels 9 ft. in diameter and more than a mile long will take cooling water from a 14-ft. intake. Pulverized anthracite duff will be used to generate the steam and is expected to give Swansea the lowest fuel cost in the United Kingdom.

▼

A.I.E.E. Program Shift.

At the instruments and measurements session of the A.I.E.E. summer convention on June 27 the following paper will take the place of "Recent Developments in Sound Measurement," by H. B. Marvin, General Electric Company:

"Report on the status of the work on noise measurement of the A.S.A. sectional committee on acoustical measurements and terminology" by Dr. Harvey Fletcher, chairman subcommittee on noise measurement.

▼

Alabama Power Assessment Stands

Though Elmore and Tallapoosa counties, Alabama, are in dispute over the allocation of the $13,000,000 assessment on the hydro-electric properties of the Alabama Power Company on the Coosa River, the Alabama Supreme Court has refused to reopen the tax assessment of the utility so that the two counties might fight the matter out once more.

▼

Illinois Merger Fight Continues

Contending that the state commission should have fixed a fair valuation for the properties involved and also placed a limit on the amount of new securities to be issued, the city of Springfield, Ill., has appealed to the Sangamon County Circuit Court from the recent ruling of the Illinois Commerce Commission approving the reorganization and merger plans of the Illinois Power Company, the Central Illinois Light Company and the Illinois Electric Light & Power Company (ELECTRICAL WORLD, March 18, page 344, and April 22, page 504).

▼

Utility Loses Second Injury Verdict

For the second time within a month a jury in the St. Louis, Mo., Circuit Court has returned a verdict against the Missouri Electric Light & Power Company in a suit brought for injuries sustained when lightning struck electric wires and entered a home served by the company at Niangua. Though the power company denied the accident was due to any negligence on its part, the jury awarded the plaintiff $15,000. On May 9 nephew of the plaintiff obtained a judgment for $5,000 against the company for similar injuries through the same accident (ELECTRICAL WORLD, June 3, page 712). Two other cases resulting from this accident are pending against the company.

▼

Large Dam Urged for Montana

Construction of a $65,000,000 dam at Glasgow, Mont., to prevent soil erosion, develop water power and permit navigation from Yankton, S. D., to the mouth of the Missouri River has been urged upon President Roosevelt by Senators Wheeler and Erickson of Montana and Frazier and Nye of North Dakota. Senator Wheeler, spokesman for the delegation, states that army engineers have approved the feasibility of the project.

▼

Denmark Reports Output

According to the most recent official report of the Danish Government Statistical Office there are 461 central power stations in the country with a total of 41 steam turbines, ten steam engines, 786 Diesel engines, 67 gas engines, 98 hydraulic turbines and 93 windmill and other miscellaneous prime movers, the total capacity being 379,728 hp., an increase of 27,124 hp. during the year. The aggregate output of power in Denmark is given as 361,620,000 kw.-hr., of which the plants in Copenhagen and Fredericksberg were responsible for about 150,000,000 kw.-hr. In addition 47,000,000 kw.-hr. was imported.

▼

300-Kv. Traveling Test Set

Completion of a 300-kv. traveling cable-test set for Compania General de Industrias y Transportes of Buenos Aires by Siemens & Halske (Germany) is announced. The equipment consists of a hauling tractor, a transformer trailer and a power-generating trailer. Transformers, condensers, a mercury-arc rectifier and special switchgear are included.

▼

St. Louis Joins the Shut-Offs

Half of the street lights of all major thoroughfares outside of the downtown district of St. Louis, Mo., are, according to the city's chief electrical engineer, to be shut off as an economy measure. During the 1932-33 fiscal year the lighting division spent $1,037,500, while its appropriation for 1933-34 has been cut to only $900,000. In the economy step energy will be withheld from 6,914 lamps, but the candlepower of 3,251 lamps will be increased to compensate for the loss of light. Increasing the candlepower of 3,251 lamps will cost $14,000 in operating cost, while the saving by turning off 6,914 lamps is estimated at $113,662, or a net saving of $99,662.

▼

As to Rates——

• Resuming its hearings on electric rates as charged by the utility companies serving the metropolitan area of New York City, the Public Service Commission last week heard Frank Carstarphen, assistant corporation counsel, attack the salaries of high ranking public utility officials. Attorneys for the companies protested and the commission decided to take the matter under advisement. In the course of the hearing Milo R. Maltbie, commission chairman, ordered the Yonkers city counsel to prepare a subpoena and to force the issue by court order if the books of the Yonkers Electric Light & Power Company were not forthcoming by June 19. This decision came after a statement by William Ramson, counsel for the Consolidated Gas Company, that the Yonkers company was not ready at this time to permit the city of Yonkers to examine its books or permit the city to investigate its records.

• New electric rate schedules of the New York Power & Light Corporation extending the standardization of the commercial and power rates to the Glens Falls and Broadalbin districts, with consequent reductions of more than $51,000 to commercial and industrial users of electricity in these districts, have been approved by the commission. The new rates are identical in both districts and are the same as those recently made effective in the Albany district and will be used to meet all commercial and industrial requirements.

• In conference last week with Governor Horner and B. F. Linkheimer, chairman of the Illinois Commerce Commission, James Simpson and George A. Ranney, chairman and vice-chairman, respectively, of Commonwealth Edison Company, Public Service Company of Northern Illinois and Peoples Gas Light & Coke Company, told the Governor that the companies they represented were willing to make some rate adjustments that are in conformity with the present situation of the utility business and expressed a desire to discuss utility rates in conference with the chairman and members of the commission.

• In a complaint filed with the Public Service Commission Isaac Hassler, attorney and former secretary of the Philadelphia Bar Association, charges that rate changes of the Philadelphia Electric Company which became effective March 2 are "illusory and of no value" and will result in no saving to

the user or consumer. He asks for an immediate investigation and thorough inquiry into the present rates of the company. The commission will hold a hearing in the matter June 19.

• A reduction of at least 20 per cent in the rates of all public utilities in St. Louis has been urged by the board of directors of the St. Louis Real Estate Exchange in a resolution adopted. The city administration is asked to demand the cut from the State Public Service Commission. The utility rates have not been lowered in accordance with other costs, the board declared, saying, "since 1929 commodity prices of all kinds have reached pre-war levels and property values have depreciated, incomes have been reduced, assessments on real estate have been reduced 20 per cent, building costs and reproduction costs have decreased from 40 to 50 per cent of their peak."

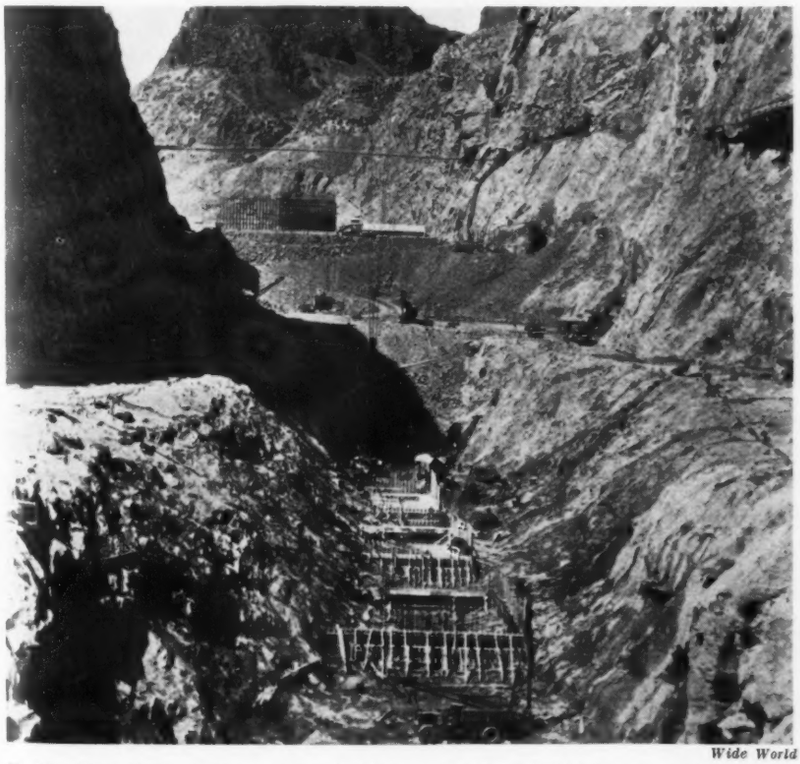
• Charging that the present rates of the East St. Louis Light & Power Company are excessive and unfair and based upon pretended valuation schedules, special counsel for the Lansdowne Improvement Association of East St. Louis at a hearing before the Illinois Commerce Commission declared that a 40 per cent reduction would be just. The company has demanded a full and complete investigation into its rates, declining to settle the matter by conference. The hearing followed a notice served on the company by the commission to show cause why its rates and charges should not be reduced.

• In reply to petitions recently presented and signed by more than 3,000 Lorain consumers, the Ohio Public Service Company has informed city officials that it could make no reductions in electric light rates.

• Expansion of the city light plant with federal funds to compete with the Rail-Light Company in furnishing cheaper electric current to homes and businesses in all parts of Columbus, Ohio, is under consideration by the City Council. Plans are under way for setting up the plant as a separate utility, paying its own expenses and using any profits to expand its facilities or to reduce rates to customers. As a separate utility, the light plant could obtain the funds needed for expansion under President Roosevelt's public works program without the necessity of a bond issue being approved by the city's voters. B. W. Marr, president of the Rail-Light Company, will report to City Council soon as to whether or not the company can grant a voluntary reduction in rates at this time.

▼

Concrete Pouring Begins at Boulder Dam



Wide World

Following two years of preliminary work, pouring of concrete for Boulder Dam began last week ("Electrical World," June 10, page 743). Forms were in place for pouring at three points when the first steel bucket load was dropped into place. It will take 7,000,000 tons to complete the job. A downstream view from above the dam site.

With the Legislators

ILLINOIS—Governor Horner has sent a special message to the House and Senate urging passage of a bill giving the state Commerce Commission greater control over public utilities and their affiliates. The bill is pending before the House committee on public utilities. The Governor has also suggested an amendment to the bill prohibiting all public utility companies from either directly or indirectly, through officials, directors, attorneys and other employees, contributing any moneys to any political party or candidate for public office.

MASSACHUSETTS—After a long and heated debate the Senate has passed to engrossment the bill which provides that companies selling electricity and gas must maintain one rate which does not have a service charge. An amendment was defeated which provided that the companies could make no change in rates until they had first secured approval of the Department of Public Utilities.

WISCONSIN—The Loomis resolution for an amendment to the Constitution to permit the state to engage in the public utility business has been adopted by the Senate by a vote of 21 to 12 with two amendments. This resolution was first adopted at the 1931 session. A constitutional referendum must pass two sessions before it is submitted to the people, but the resolution was changed by the Senate at this session so that it must be approved by the 1935 session before it can be voted upon by the people. The Senate also disposed of two bills aimed to tax electrical output in the state to furnish $1,000,000 a year for old-age pensions. The Polakowski bill on the subject was amended to provide merely that a person can draw an old-age pension in spite of property ownership. The Fons bill to levy a tax of ½ mill per kilowatt-hour of electricity generated in the state to raise old-age pension funds was killed.

▼

Probe of Arkansas Utility Asked

In a City Council resolution placed before the state fact-finding commission complete investigation of operations and policies of the Arkansas Utilities Company in Paragould is asked as the city prepares to fight court action brought by the utility to prevent erection of a municipal power plant. The state fact-finding commission was created by the Arkansas Legislature this year to aid municipalities in regulation of utilities. Authorized by Council action last December and voted by a big majority in a referendum in January, the city's municipal plant project had been held up pending settlement of court action brought by the company.

EDITORIALS

L. W. W. MORROW
Editor

Lower rates, higher taxes and sales

UNJUST and punitive taxation has been pressed upon the light and power industry, coupled with a popular clamor for lower rates. All this on an ebb tide of business. What can be done?

Although too late to be effective, the facts about taxation and the analysis of W. C. Mullendore at the E.E.I. meeting should be told in every service community by utility executives. In addition, definite facts should be told and advertised to the public about the expenses and earnings of each local property. Add to this understandable information about local rates and the reason for them. These measures are logical as defensive acts and are effective and advisable to acquire and maintain an informed local public.

But defensive acts will not meet the present business emergency. Taxes have increased and will increase. Rates have decreased and promise to continue to decrease. Therefore, the only effective way to meet the situation is to increase earnings by increasing sales. This increase must be large and it must occur quickly. The range and the water heater must be added to the refrigerator and to other appliances. As pointed out by P. S. Arkwright at the E.E.I. meeting, it is not a question of desiring to sell; sales must be made as the only alternative to bankruptcy in many instances.

Necessity thus creates the sales opportunity for the industry. Old methods and old conceptions of sales volume must be junked as inadequate and obsolete. There must be money, a method, sales promotion and a sales organization adequate to the magnitude of the sales necessities. But nothing is done or is contemplated on the scale required. The same old selling in the same old way prevails and progress is too slow to have any effective relief action upon the present business necessities. Both the manufacturers and the utilities fail to realize that dire necessity calls for co-ordinated action to build a volume of sales heretofore never considered by the industry. Conditions are too critical to play with amateur merchandising.

Penny pinching in industrial substation design

IN THE design of industrial substations reliability of service is the major objective of the power user. He may not realize this when under pressure to keep construction costs as low as possible, but the over-all economy of this class of service is vitally dependent on its continuity, and nearly as much so on its quality. When using purchased power there is little danger of providing transformers of insufficient capacity for present needs, regardless of who pays for them. The power company will not try to skimp such installations at the current prices of even moderate-sized transformers per kva., and if the factory purchases high-tension energy and steps it down in its own equipment the engineering department of the utility is almost certain to exercise enough supervision of the program to prevent protracted overloading. The real dangers of penurious policies on the part of the substation owner who determines the appropriation where the power company does not engineer the installation lie in inadequate layouts.

Modern power transformers and circuit breakers may be "bears for punishment," but this does not justify relegating them to wet and poorly ventilated quarters fit for nothing else than sump pumps. Too often the factory management balks at a proper allocation of space for such equipment. Cast-off corners which do not admit replacing units quickly in case of interrupted service, which require the operator to make a right-angled turn before he can open a

switch manually and which pocket warm air to a degree which reduces the capacity of the bank unless an expensive fan installation is temporarily set up to save the day certainly do not represent the type of engineering to which reputable concerns engaged in manufacturing are entitled. Makeshifts in the location of cable potheads and high-voltage breakers to save yard space and outlays in wiring are sometimes found to create special hazards to employees of other departments obliged to work in their vicinity. Inspectors from municipal departments are not always as critical from the standpoint of safety as they might be, and have been known to pass installations which an insurance engineer might expect to "get by" temporarily, although such layouts would not be approved for the long run.

No matter who designs an industrial substation, the responsibility for its continuous and safe service should be the paramount consideration. Details like the number of feeders required and their flexibility of operation, metering facilities and provision for growth are matters for the engineer to handle, but the attempt to save money by the use of too old equipment, by crowded, ill-ventilated and inaccessible layouts should be revealed to the appropriation maker as pennywise and pound foolish, when balanced against the cost of interruptions, fires and accidents.

Suggestions for conductor vibration

HIGH and low frequency vibrations exist on transmission lines. These create a service hazard through conductor failure that is acute with steel core aluminum conductors. The vibrations increase with length of span and conductor tension, but the use of more towers in a line is very expensive. The use of rods at insulator clamps to spread out the forces also is expensive and debatable as to effect. Thus a serious economic and practical problem confronts the industry.

Essentially, fatigue of metals is a corrosion effect caused by internal oxidation, and it would seem logical to attack the vibration problem by use of better conductor manufacturing processes. It is suggested that a high-strength steel core be used that is covered by a non-oxidizing metal coating such as can be produced by galvanizing or electrodeposition. It should be advantageous also to anneal the aluminum strands very thoroughly and possibly even to cover them with a non-corrosive metallic layer. These fundamental approaches to a solution of the vibration problem should be less expensive and more effective than the cut-and-try efforts used on conductors after they are manufactured.

Time to be outspoken

TRUSTEE-MANAGERS of the light and power industry have been silent too long under the malicious attacks of professional faultfinders. They are obligated to defend the assets of the thousands of employees, bondholders and stockholders and to insure adequate electric service at reasonable rates for the communities they supply with light and power. They should be militant in defending the public interest.

As usual, Alex Dow put his finger on the logical way to defend the industry against demagogic attacks. He said local advertising should be used. This copy should be in the common speech of the day and should be signed by the utility executive. When there is a lie large enough to deserve recognition it should be called a lie, and in many instances the liar should be named. A reiteration of facts and policies supported by corresponding acts is the way to earn and keep public support.

There is plenty to advertise. The mental dishonesty of indirect and punitive utility taxation; balance sheet facts to show that earnings are only fair and often inadequate; logical statements about rates and the cost of distribution; merchandising policies—all these are local facts for local advertising copy. In addition, the facts are now available on the national situation and the recent paper of B. F. Weadock gives illuminating data and interpretation of the Federal Trade investigation.

Local, state and national governments now dominate the utility industry. Behind these lie the votes of the people, and the good or bad effects of the intervention of government into industry affairs depend upon intelligent understanding of industry facts and policies by the voters. The major task of a utility executive is to see that the public has the facts so that government will aid and not injure the industry. In the final analysis, the public interest is the same as that of the industry. It is time to speak, to advertise and to fight professional faultfinders. This is not a policy of propaganda; it is an executive obligation.

Fundamental Consideration in Preparing Master System Plan

By W. J. LYMAN*

Electrical Planning Engineer, Duquesne Light Company

FUNDAMENTALLY, this is a world of ever-changing conditions, and it is inevitable that no enterprise can make uninterrupted progress without continuously adapting itself to the changing trends.

As an example, the raising of new capital can, in general, be justified only by prospective increases in earning power. During a period of rapid expansion new money can be secured very easily, not only for extensions but also for replacements and improvements. As the rate of growth diminishes additional capital is harder to secure and greater demand is placed on current revenues by deterioration and obsolescence requirements. These gradual changes in the proportions of the income statement should be largely foreseen and provided for.

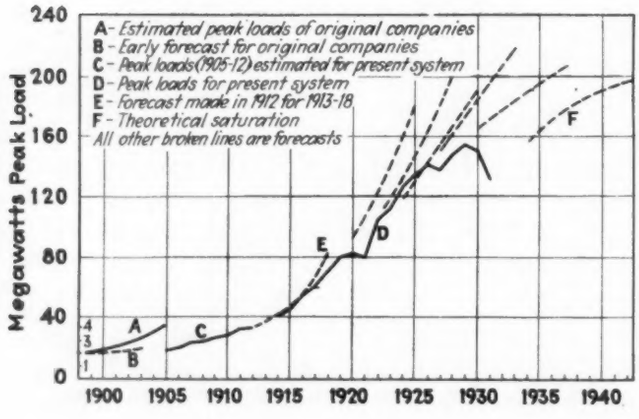
During the period of rapid load increases the common error of overestimating the coming year's load does not involve serious consequences because the additional capacity resulting will most certainly be needed a year or two later, and the increased efficiency will probably pay for most of the added fixed charges. This is not true after the load growth has dwindled and become more uncertain. In this case surplus capacity resulting from overoptimism presents a more serious problem. Equipment units are probably of larger capacity and several years may easily be required properly to load one up, during which time the increase in efficiency, now much smaller, pays only a small portion of the fixed charges.

During the past ten or fifteen years improvements in efficiency of electric systems (particularly in generating costs), together with the increase in size and load density, have made possible frequent substantial rate reductions, and this has gone far to discourage and practically eliminate most forms of competition. As physical and economic limits of efficiency are more closely approached further reductions in cost of service will depend more on decreased unit investment costs, which, in turn, will require more attention to the standards of service and the proper relation between load and capacity. The investment per kilowatt of load has, in general, been increasing for many years, a trend which can be reversed only by the most careful co-ordination of

*Abstracted from James H. McGraw first prize paper.

Fig. 1—Load forecasts of past compared with actual loads developed

Based on actual records for a specific system.



The earliest forecast available was made in December, 1898, predicting a 3 per cent increase in revenue the following year and new capital requirements for betterments and extensions of 2 per cent per year for a five-year period. It is quite evident that these men had no conception of the tremendous growth in store for the company. The reason may be partially explained by the fact that the increase in revenue for the two years prior to December, 1898, had averaged only 3.8 per cent per year. The actual increase in revenue for the next seven years was 14 per cent per year, and for the thirty years following 1898 was equivalent to more than 13 per cent per year compounded!

The next forecast now available was made in 1912-13. After a very extensive analysis of past records and the probable future market, a prediction was made of the load growth from 1912 to 1918, as shown. The first four years coincide very closely with the actual load, and it is only the last two years of the curve that subsequently proved to be too high. This conformity, in view of the fact that the program called for taking over a definite surveyed load by the end of the six-year period and was probably intended to be optimistic, illustrates that this was the period in which the popular expectations of development for the several years following proved to be very nearly correct.

This attitude toward growth seems to have prevailed for the next five or six years, for even during the latter part of the World War, when all plant facilities were loaded to their limit, the management was apparently very reluctant to invest large sums in additional capacity lest the conclusion of the war leave them with unnecessary equipment installed at abnormal prices.

The next forecast shown, however, made in 1921, proves that by this time the future outlook had swung from skepticism through realism to intense optimism. It envisioned a 15 per cent per year compounded growth, giving peak loads much greater than actually developed. From this point on each succeeding forecast had to be revised downward to keep in step with the actual trend.

The 1927 forecast is the first one shown embodying the decreasing slope or "saturation" idea. At the time this was considered a pessimistic outlook, although it is now evident that the spirit of optimism was still fundamental. The recent depression is not entirely responsible for these inaccuracies because these forecasts had shown their inadequacy prior to 1930. The last forecast shown was obtained merely by applying mathematically a standard "S" curve to the past load data, allowing for assumed "depression periods," and does not necessarily reflect the prevailing opinion.

future load, system capacity, income statement and balance sheet.

Another factor that will undoubtedly become of greater importance is the replacement of obsolete and inadequate equipment. During the last decade the load was increasing and additional equipment was being added so rapidly that apparatus more than ten or fifteen years old was only a small portion of the total fixed capital, and necessary replacements were dwarfed by comparison with current revenues. In the future, even though the useful life of equipment proves to be double what it has been in the past (a dubious possibility), the requirements for retirements will in time reach at least twice their present percentage of gross revenue. The prosperity of many an enterprise has been terminated by inadequate provisions for future replacements.

Three vital factors in master plan

A determination to recognize these factors, as well as the many other advantages of systematic planning, will probably result in the preparation of some form of master plan. This plan will set forth the service requirements, basic engineering principles, general system layout and a co-ordinated future plan to serve as a pattern for the development of the system, and also a logical financial program that will insure a proper balance between revenues, operating expenses, financial obligations and system improvements. The master plan, in its truest sense, does not include a detailed construction program, but serves rather as a guide for the preparation of the annual budget.

Three of the most vital problems around which the whole fabric of future planning is woven are forecasting, the relation between load and capacity and fixed capital replacements.

Forecasting—Long-range forecasting requires, more than anything else, an understanding of the law of inevitable change and the ability to project into the future and detect basic trends and new influences which are obscure or invisible in the present. It is largely by discovering or foreseeing conditions not generally realized and deviating from the popular outlook that long-range forecasting can be of real value and be the means of avoiding undermining influences. And by this same token forecasting is made difficult through the necessity of properly discounting the trends established in the past and the uninformed or biased expectations for the future. It would almost seem that in many cases an accurate and accepted forecast (particularly if pessimistic) is necessarily self-destructive and impossible, since the public knowledge of future conditions which is implied would bring into play opposing forces preventing consummation of the prediction. To the extent that this element enters the problem, it is necessary for the forecaster to "buck" public opinion and popular theories and steer a true course guided by sound principles and the broad experience of industry.

There are many adherents to the so-called "S" curve, or growth saturation theory, as applied to individual developments and industries. This "S" curve shows a very moderate rate of growth at the beginning, gradually increasing to a maximum at the halfway point, and then steadily decreasing as "saturation" is approached. Population growth and many developments in nature follow more or less closely along this type of curve. Commerce or industry, however, taken as aggregates, are practically certain, in a nation such as ours, to show a reasonably steady increasing trend generation after generation. Such is rarely true, however, in cases of individual enterprises. These are conceived to meet a new demand or, more often, to do some existing job better and more economically. Born as they usually are, at the expense of a superseded enterprise, they prosper over a limited period, only to be ultimately curbed through the development of newer and better methods by the same progress which gave them birth.

To a certain extent the electric light and power business enjoyed a rapid growth by taking over the work already being done by agencies such as the steam and internal combustion engine, gas lights and furnaces, hand labor, etc. The electric companies have, however, gone considerably further and developed new fields for the sale of electric power, such as in the home. However, even in the domestic field, most electric appliances perform tasks formerly done by more arduous and less efficient means.

It is probably in the fields where entirely new uses have been introduced that the most rapid expansion will occur during the next several years. Although the growth cycle of the central station electric business will, due to its composite nature, undoubtedly extend over a longer period than for many more specialized enterprises, it can hardly be expected to continue indefinitely at the rate enjoyed during the last decade. A distinction which, in the future, may become more significant must be made between (a) the use of electricity and (b) the sale of electricity by central station companies.

For years it has been the custom for prizes to be awarded for the most meritorious papers on electric light and power subjects submitted in a contest administered under the auspices of the N.E.L.A. With that organization discontinued, the Edison Electric Institute took over the administration of the prizes and has just made its announcement of the winning participants. The James H. McGraw first prize goes to the author of the paper presented here.

In it the author discusses what he considers the three most important elements in preparing a master plan—forecasting, establishing a relation between capacity and load, and replacement of fixed capital. The most valuable forecasts are those which recognize changes in trend not generally appreciated. Frequently the forecaster must run counter to public opinion with little support. If cost of service is to be reduced, the author contends, there must be a more scientific correlation between load, capacity, service continuity, equipment reliability and overload capacity. Some typical cases are cited to illustrate how probability methods may be applied. Fixed capital replacement is expected to become a greater burden on revenues than at present and the author illustrates by a typical case how an analysis of the probable trend might be made.

It is important to trace the changes in the popular expectation of future growth during the various stages of the development of an enterprise. At its inception the public is usually unwilling to admit the possibility of success. It is only through the vision and persistence of the pioneers that a meager start is made. Furthermore, it is probably true that even these earliest pioneers in their enthusiasm fall far short of the ultimate magnitude of the development actually realized after the talent of the engineering and commercial world has been brought to focus on its problems.

However, after the daring promoters have demonstrated the success of their ideas and the financial stability of the business, the public which had condemned it a few years before now recognizes its merit, and, assuming the prophetic task of the pioneer, characteristically allows its unbounded enthusiasm to picture an unlimited continuation of the rapid growth all out of proportion to the real prospects. After this stage of development has been reached the long-range forecasts are quite likely to be too optimistic. A study of these tendencies is of utmost importance to the forecaster.

This theory regarding the probable trend in long-range forecasts is demonstrated in the case presented here (Fig. 1).

Spare Capacity and Service Continuity—A major problem in the design of a power system arises from a combination of the desire to render reasonably continuous service and the inherent fallibility of equipment. A rather large proportion of the fixed capital is so occupied, and a careful analysis of the relation between load and capacity is the starting point in an effort to reduce cost of service. At the beginning of the last decade service continuity was not consistent with the greatest use of electric power. Consequently, reserve capacity for breakdowns has been steadily increased, while the failures have been greatly decreased by improvements in practically all component parts of the system. During this period the total duration of outages has in some cases been reduced 90 per cent. Research and development in the field of breakdowns will result in still greater equipment reliability, and new, or revised, standards of spare capacity will be necessary. The remarkable operating record of oil-filled cable is interesting in this connection.

This subject involves to a large extent the science of probability. This does not necessarily imply a theoretical or highly mathematical calculation, or even a different line of reasoning. Experience has shown that breakdowns of varying frequency may be expected from different types of equipment in different locations, and the standards of spare capacity used in the past have in reality been "rule-of-thumb" probability solutions. It is evident that 100 per cent continuous service cannot in any case be guaranteed, but that this goal can be approached in a definite way by reducing the probability of outage.

It is suggested that a thorough study of equipment performance, normal variations in load, relative probability of different kinds of outages, and of service continuity at different points on the system will result in a better co-ordinated distribution of spare capacity from the generator to the consumer and the best ultimate results for the minimum of cost. By comparison on a common basis, the cost of the reliability element in each section of the system can be determined and com-

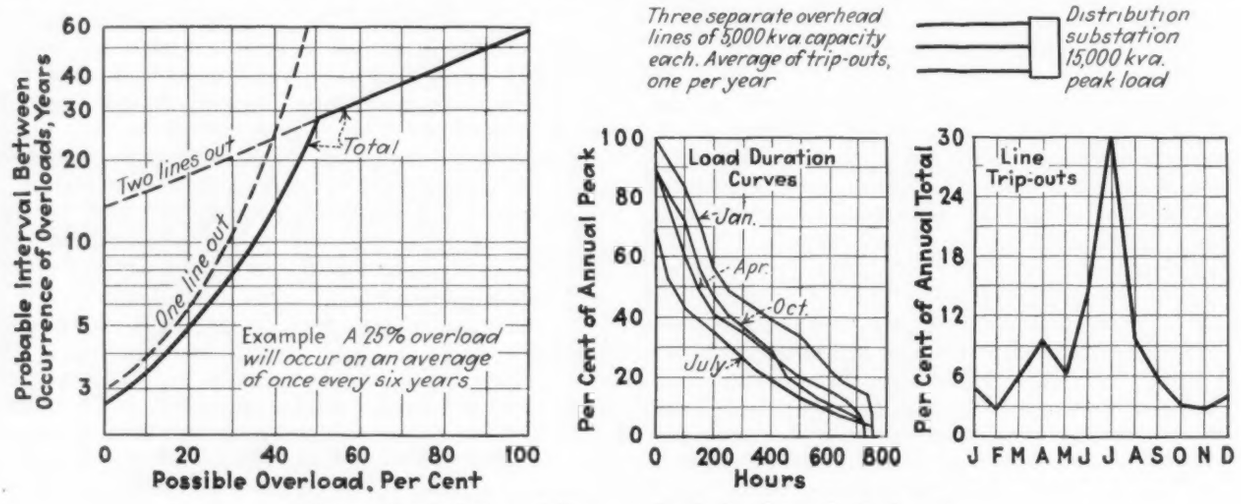


Fig. 2—Probability of line overloads for hypothetical case

The case selected is that of a hypothetical distribution station with a peak load of 15,000 kva. supplied by three high-tension lines of 5,000 kva. capacity each. These lines are each 3 miles long over different routes and, as shown by experience, may be expected to trip out on an average of once a year. The average length of outages has been 30 minutes, and in only 10 per cent of the cases do they run over two hours. These outages are due mainly to lightning occurring during the summer months. Experience shows the normal seasonal variation in trip-outs. In direct contrast to this condition is the fact that the peak loads are much smaller in the summer. An analysis of the hourly, daily and seasonal variations in load shows that while the January peak is 15,000 kva., the peak in July is only 10,000 kva., and that throughout the year the load exceeds 10,000 kva. only 11 per cent of the time.

Although a line outage at the time of the station peak would produce a 50 per cent overload on the two remaining circuits, it is very improbable, since most of the few hours during which the load exceeds the capacity of two lines occur during the seasons when lightning is infrequent or absent. These fundamental factors have been combined to show the probability of having overloads of various magnitudes. The probability of overloads due to simultaneous outages of two lines is included.

Although the possibility of this occurrence at the time of the peak can be imagined, it is too remote for much consideration. With the three lines spaced an average of ½ mile apart, experience shows that in only one case in fifteen will two circuits be out together. And only 37 per cent of these would occur when the load is over 5,000 kva. (once in 13.5 years).

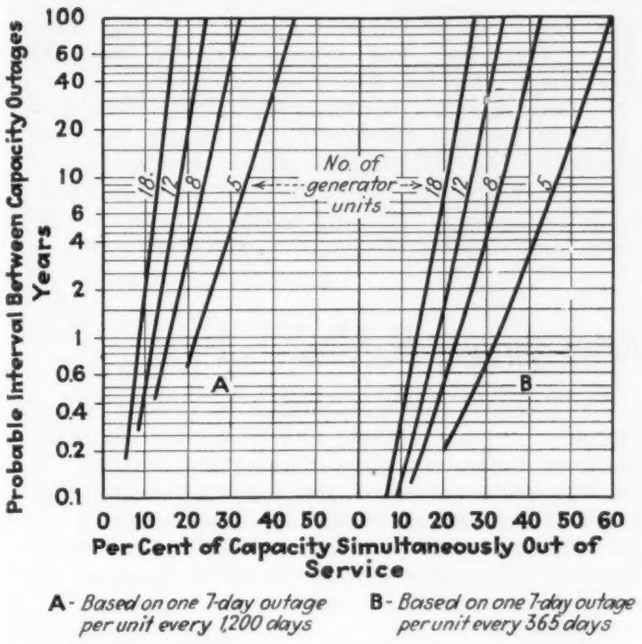


Fig. 3—Probability of simultaneous generator outages

The group of curves at the left are based on the average experience of thirteen different companies. The curves show, for example, that with eight units a double outage (25 per cent of capacity) would be expected on an average of once every twelve years. With twelve units a double outage would occur every five years, but 25 per cent capacity (three units) would not be out oftener than every 100 years, due purely to chance overlapping. A comparison was made between the actual number of double outages experienced by two large companies over a twelve-year period and the theoretical value as shown by the curves, and the discrepancy was only about 15 per cent.

pared, resulting, for example, in preventing an undue investment to reduce outages on distribution circuits while the majority of the trouble may be in the transmission system, and where better results might be secured by transmission improvements.

The first step would be to establish some rational set of service standards, presumably based on the known average performance at present and adjusted for the probable trend, special requirements, number and nature of complaints, etc. A good measure of service is the number of outages per year and the total duration (time of occurrence sometimes a consideration). The next step is to study the trend in the breakdown performance of each component part of the system and attempt to judge what may be expected in the future. This is quite important, since improvements will probably be made that will change the whole aspect of certain transmission or distribution practices. This should be followed by an analysis of customer outages as they now occur and a determination of the relative responsibilities of each subdivision of the system.

With information such as this as a basis, each improvement or addition to the system can be carefully weighed regarding the effect of alternate schemes on the probability of customer outages. When load growth begins to infringe on the percentage of spare capacity established as necessary in the past, new capacity should not be added until it has been shown that the probability of a customer outage or undesirable equipment overload is actually inconsistent with the rest of the system and the desired ultimate result.

An example is presented (Fig. 2) showing how the probability of overload could be studied in the case of a large substation supplied by overhead transmission.

The conclusion reached from this study alone is that although the substation apparently has no spare transmission capacity, only once in 3.4 years would the line rating be exceeded by 10 per cent and only once every six years would the overload reach 25 per cent. A study should be made of the effect of infrequent overloads on the various parts of the circuit to judge whether or not they are objectionable, and also if the potential hazard to service is out of line with the possible loss of power due to trouble at other places on the system. No definite conclusion should be reached until all pertinent factors have been given due consideration, but it is believed that probability studies such as this will be of great assistance in reducing unit investment without jeopardizing service.

Simultaneous or overlapping generator outages

Another example of where a probability analysis can sometimes be applied to clarify the problem is in the case of simultaneous or overlapping generator outages from causes not common to both machines. This is particularly true where large interconnected systems are involved and the generating units are widely separated. A probability study would not embrace the possibility of several units, or even a whole power plant being shut down due to some major system trouble, but this does not detract from its value, since it is seldom proposed to provide sufficient capacity to carry peak loads during such abnormal conditions which are usually of short duration. In many cases of this class additional units would be of little value, because if running at the time, they also would have been tripped off, and if idle, could not be put on the line as quickly as the ones that had been carrying the load.

Whether or not provision is made for the various contingencies depends, after all, on the probable frequency of occurrence of such an event. There is very little question about providing for breakdown of one unit because this is known to occur quite often. Furthermore, reserve is usually installed for a double outage because experience has shown that this may occur every two or three years. However, very little money is spent in anticipation of a combination of breakdowns that may

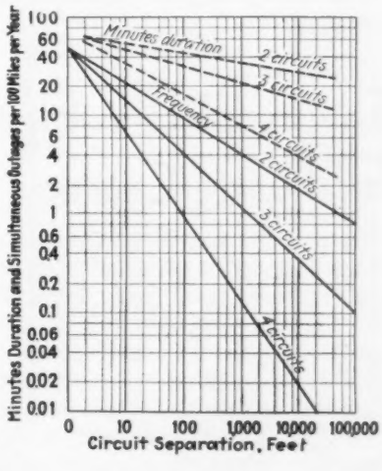


Fig. 4—Probability of simultaneous overhead line outages

Based on data from one system.

occur on an average of, say, once every twenty or thirty years.

The addition of a greater number of units to an interconnected system reduces the percentage loss in capacity resulting from any given outage, but it also increases the probability that such an outage will occur. The actual net gain in dependable capacity effected through interconnection can be calculated through probability.

The starting point for such a study is an analysis of the trend in generating unit breakdowns (regardless of overlapping) and the selection of an average frequency and duration for the period under discussion. By application of the laws of combinations, it is possible to calculate the relative probabilities of: No double outage during the average unit breakdown period, one double outage, one triple, two double outages, etc., for all possible combinations. A check of the accuracy is obtained through the fact that the sum of all the individual probabilities is unity.

In order to illustrate the results that may be obtained, the problem has been worked out (Fig. 3) for two different assumed frequencies of breakdown.

In the case of overhead line outages, a probability study such as the above would have no value, due to the fact that most trip-outs occur during storms occupying a small percentage of the year and covering relatively small areas at any one time. However, the actual performance can be analyzed and the probable frequency of double outages determined as related to the separation of circuits. The result of such a study by one company is shown on Fig. 4. The relative improvement in service of different arrangements of lines can be better judged by the use of such data.

These suggestions and typical solutions have been outlined in the belief that the fundamentals of "probability" can become a valuable aid in the solution of many power system problems, particularly that of obtaining the greatest possible use from all capital investment.

[The third vital factor in system planning mentioned at the outset of this discussion, namely, "fixed capital replacement," will be presented in a later installment—EDITOR.]

▼

Favors Electric Heat for Fusing Caustic

Electrically heated caustic fusion pots will last three times as long as when coal fire is used, and indications are that the cost of maintaining electric furnaces will be far less than repairing coal-fired pot settings. Furthermore, the uniform distribution of heat reduces the risk of the pots boiling over. So reported John Hedalen, chemical engineer of the Canadian International Paper Company, in a recent paper before the Electrochemical Society. When using caustic liquor of 48 deg. Baumé concentration the energy consumption for producing fused caustic is 1,410 kw.-hr. per ton at the Temiskaming, Que., plant.

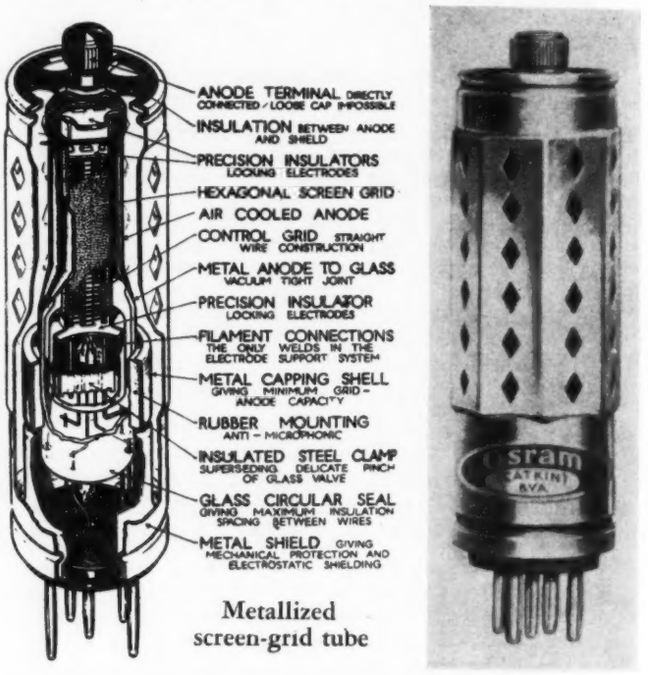
A temperature of 1,250 deg. F. is automatically maintained around the 16-ton pots of caustic by nickel-chromium alloy resistors supported on special refractory brick built into the side walls of the pot settings. The walls and floor are faced with 9 in. of fire brick backed by an equal thickness of silocel brick and 4½-in. exterior wall of red brick. The furnaces are rated at 500 kw., 550 volts, three-phase.

The caustic liquor is first brought up to 600 deg. F., when one heating circuit is turned off for two hours. Thereafter both heating circuits are kept on and the batch finished at 830 deg. F. It takes about 3½ hours to bring the caustic liquor to the boiling point and about 48 hours total time to complete the process of fusing.

▼

Metallized Radio Tubes

Radio receiving tubes which, it is claimed, may be dropped 6 ft. on a concrete floor with little risk of damage from fracture or altering the critical electrode spacing are being placed on the market by the General Electric Company, Ltd., and the Marconiphone Company, Ltd. Furthermore, they are smaller than the conventional glass bulb and are reported to have more uniform characteristics and be freer from microphonic effects, according to the *Electrical Review* (London).


ANODE TERMINAL DIRECTLY CONNECTED / LOOSE CAP IMPOSSIBLE
INSULATION BETWEEN ANODE AND SHIELD
PRECISION INSULATORS LOCKING ELECTRODES
HEXAGONAL SCREEN GRID
AIR COOLED ANODE
CONTROL GRID STRAIGHT WIRE CONSTRUCTION
METAL ANODE TO GLASS VACUUM TIGHT JOINT
PRECISION INSULATOR LOCKING ELECTRODES
FILAMENT CONNECTIONS THE ONLY WELDS IN THE ELECTRODE SUPPORT SYSTEM
METAL CAPPING SHELL GIVING MINIMUM GRID - ANODE CAPACITY
RUBBER MOUNTING ANTI - MICROPHONIC
INSULATED STEEL CLAMP SUPERSEDING DELICATE PINCH OF GLASS VALVE
GLASS CIRCULAR SEAL GIVING MAXIMUM INSULATION SPACING BETWEEN WIRES
METAL SHIELD GIVING MECHANICAL PROTECTION AND ELECTROSTATIC SHIELDING
Osram
KATKIN
KVA
Metallized screen-grid tube

The accompanying cross-section illustrates their construction. A cylindrical copper container, serving also as anode, replaces the usual glass envelope. The vacuum seal is completed at the lower end by glass through which the grid and cathode leads emerge at liberal spacing for connection to the terminals. The grid and cathode are rigidly held concentric with the inclosing anode-container by mica-spacing pieces fitting snugly therein. This construction allows of considerable accuracy in spacing the elements. The anode terminal is connected directly with the copper cylinder which forms the major part of the vacuum inclosure. This entire assembly in turn is mounted inside a ventilated metal shell, being held by the rubber ring and metal capping shell shown. Microphonic howling is said to be greatly reduced by this construction. Cooling and reduction of gas evolution inside the tube are aided by using the anode as the major part of the vacuum inclosure.

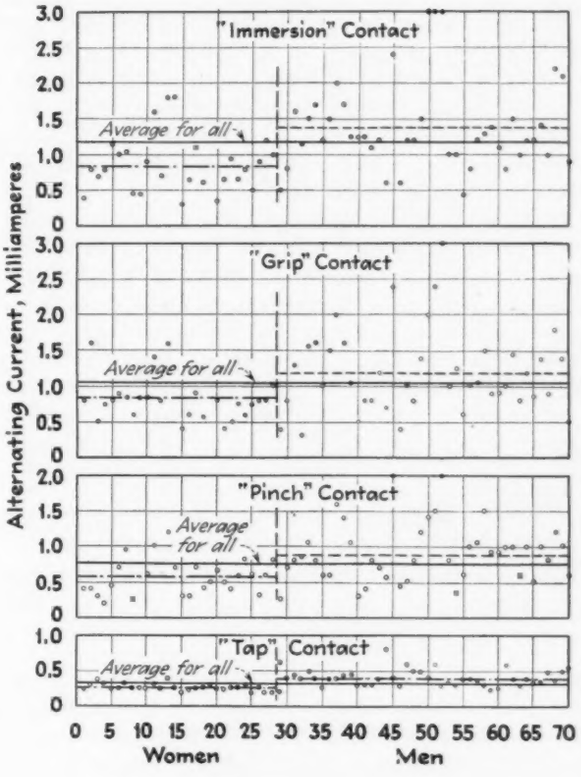
Shock Threshold Fixes Appliance Insulation Resistance

By GORDON THOMPSON

Assistant Chief Engineer
Electrical Testing Laboratories, New York, N. Y.

THE modern public has been educated from many sources to believe, rightly enough, that the best way to perform a task is to do it electrically. It is in the best interest of, and hence, obviously, it should be the aim of, manufacturers of electrical equipment and of the central-station companies which supply the electrical energy to operate that equipment to foster and preserve this customer good will. It is inimical to that purpose to permit a feeling of fear or even of apprehension to come to be associated with the use of electrical devices. The formation of such attitudes can be forestalled only by insuring that under no normal conditions of operation can the user be traversed by current which he can perceive physiologically. In other words, he should never receive a sensation of shock so long as he uses electrical appliances in a reasonable manner.

It is a matter of considerable interest, therefore, to ascertain the minimum or threshold value of current which the average person can perceive. Most shocks are received through contacts which are made by the hands, and this current path is the one that was chosen in an investigation made with 70 adult persons as the subjects. Of this number 28 were women and 42 were men. The women were engaged in clerical and light laboratory work, while of the men 27 were engaged in general laboratory and office work and the fifteen others were engaged in some form of manual labor. Suitable circuits and measuring instruments were used to determine the smallest 60-cycle alternating current which could be physiologically perceived as it passed from one hand to the other of each of the subjects. The left hand of each person was immersed in a weak saline solution covering the wrist, the metal container being connected to one side of the test circuit. The right hand made contact with the opposite side of the electric circuit according to several selected methods. One form of contact involved tapping a metallic surface with the tip of the forefinger; a second required a metallic surface to be pinched between the thumb and forefinger up to the first joint; in the third, a long cylindrical metal rod 1 in. in diameter was grasped with the right hand, while in the fourth the right hand was likewise immersed in salt water up to the wrist. The observed values of current for these 280 observations have been plotted in the diagram; average values for the men, for the women and for all 70 persons have been indicated. The accompanying table gives the maximum and minimum values in each case as well as the average.



Seventy adults tested for minimum perceptible "shock" current

Physiological perception of alternating current. Threshold values for different kinds of contacts

From this it would appear that the sensation of electric shock is proportional to some extent to the current density over the contact surface of the body. The proportionality is not a direct one, since the ratio of threshold current for the immersion contact to the threshold current for the tap contact is a little more than three to one, whereas the area ratio must have been several hundred to one. Furthermore, it was a matter of common experience on the part of the subjects that sensation was initiated at any perforation of the skin, such as a cut or abrasion; computed current density would be significant only if the skin were unbroken.

Threshold Values of 60-Cycle Alternating Current Physiologically Perceived

(Values are expressed in milliamperes)

Type of Contact	28 Women — Avg.	Max.	Min.	42 Men — Avg.	Max.	Min.	Average for All
Tap	0.27	0.40	0.20	0.40	0.80	0.20	0.34
Pinch	0.59	1.20	0.20	0.87	2.40	0.26	0.76
Grip	0.84	1.40	0.50	1.19	3.00	0.28	1.05
Immersion	0.88	1.80	0.30	1.39	3.00	0.44	1.18

However, it is not the purpose here to inquire into the mechanism by which the passage of current is perceived in the human body. It is of greater immediate interest to note that, in general, a woman can perceive a current as small as 0.27 milliampere in the casual contact represented by tapping an electrified surface with her forefinger. The counterpart of this action in daily life might be the act of the housewife who is testing the temperature of the soleplate of her flatiron with her forefinger while grasping a water faucet with the other hand. This maximum sensitivity of perception decreases somewhat, it is true, when contact with the electrified surface involves a larger area. With the tap contact one perceives the passage of about one-third of a milliampere; when the hands grasp a more extensive metallic surface or are completely immersed in water to the wrists a current slightly greater than 1 milliampere is required to give a perceptible reaction.

If these values are translated into a value for the insulation resistance which must be found in an appliance, large enough to prevent the sensation of shock when the device is used on a 120-volt circuit, it is evident that a resistance of not less than 120,000 ohms must be interposed between the "live" side of the line and any accessible metallic surface of considerable extent which the user might grasp. If shocks attendant upon a pinch contact are to be eliminated the resistance must be greater than 160,000 ohms. For the tap contact the resistance must exceed 350,000 ohms.

And, finally, if the possibility of shock to the "most sensitive" person is to be avoided, the insulation must interpose a resistance of not less than 600,000 ohms.

These measurements were made on adult persons in good health. For various reasons the investigation was not extended to children, but there is reason to believe that they are capable of perceiving still smaller currents.*

No reliance can be placed on body resistance

The resistance of the body of the user may not be relied upon to assist in limiting the current to an imperceptible value. Or, stated in other words, the voltage drop across the subject is only a small fraction of 120 volts. In fact, the highest voltage drop across any person in this investigation was only 26 volts, across a man with the "pinch" contact. The highest resistance observed was 100,000 ohms, a woman making the "tap" contact. Average values were considerably below these. They were as follows:

	Average Body Resistance, Ohms			Average Voltage Drop Across Subject, Volts		
Type of Contact	Women	Men	All	Women	Men	All
Tap	43,700	33,400	37,500	11.5	13.2	12.5
Pinch	14,100	13,900	14,000	7.0	10.6	9.2
Grip	7,400	7,350	7,350	6.0	7.6	6.9
Immersion	1,700	1,440	1,540	1.5	3.0	2.3

Now it is true that the values of current given in the preceding table are threshold values; they correspond to the first perception of the physiological reaction we call "shock," by persons intent on detecting such a reaction. And it is also true that fatal currents are probably at least one hundred times these threshold values. But it is likewise a matter of experimental knowledge that currents which may be classified as "intolerable" are only some ten times the threshold values.

Measurements of "intolerable" currents were made at the conclusion of the threshold determinations. With the left hand immersed in salt water the subject grasped with his right hand a large metal handle connected to a variable-ratio auto-transformer; as he turned the handle he thereby increased the voltage applied between his hands. He was encouraged to increase the voltage until his arm (wrist) muscles would no longer respond to his wish. The psychological obstacles to obtaining consistent values in such work are apparent and it is evident that considerable hazard attends the experiment. The average value of "intolerable" current so obtained was 5.15 milliamperes for the women, 8.35 milliamperes for the men, 7.1 milliamperes for all. The maximum values were 20.0 milliamperes for a man, 8.8 milliamperes for a woman. From this it follows that an insulation resistance below about 20,000 ohms would permit an "intolerable" current to flow in an appliance connected to a 120-volt circuit. Also it appears that painful reaction to the passage of electric current sets in rather promptly after sensation has been inaugurated.

It seems logical to conclude, therefore, that the best policy would be to provide domestic electrical appliances with insulation of such characteristics, in such quantity and so disposed that under no normal conditions of use could the leakage current exceed a value of, say, 0.2 milliampere. Establishment of this value as a minimum requirement would then give at least a small factor of safety to take care of the decline of insulation which would take place with use and with age.

In selecting an insulating material on the basis of desirable electrical characteristics the two factors which are of chief importance are the tendency to absorb moisture and the change in resistivity which takes place with changes in temperature. Charts published by the United States Weather Bureau show wide areas in the United States where the average relative humidity is above 90 per cent for considerable portions of the year. When exposed to atmospheres containing so much water vapor a number of insulating materials take up sufficient moisture to cause the insulation resistance to fall to a fraction of the value which the material possessed at humidities of the order of 40 to 60 per cent.

Insulation must be adequate under humidity

The insulating materials used in electric heating appliances are subjected to temperatures as high as 1,600 to 1,800 deg. F. Here again many insulating materials show a resistivity which may be but a thousandth part of that which the material has at room temperatures in the neighborhood of 70 deg. F. The designer is, therefore, often called upon so to treat a material and to provide it in such quantity that it shall maintain a satisfactory resistance while the device stands unused in the humid atmosphere of a seaside cottage and yet shall not fall below an acceptable value when brought to the operating temperature produced by the incandescent wire

See, for example, "Accidents de l'Electricité," by Dr. Zimmern, Bulletin de la Société Francaise des Electriciens, 5th Ser. Vol. 1, September, 1931, page 907.

of the heater element. This limits the choice of insulating materials and imposes a requirement for care in design.

The skill of the designer is still further taxed as he attempts to secure speed of operation for his heating appliances. To achieve speed the thermal mass in both heater element and surrounding refractory insulation must be kept to a minimum. Assuming that he has obtained an insulating material possessed of a satisfactory resistivity at incandescent temperature, the designer will use as little material as possible, but it often happens that the electrostatic capacity of the condenser which is formed between the heater element and an encasing metal sheath then becomes sufficiently great to permit an objectionable value of leakage current to flow at rated voltage due purely to the charging current of the condenser.

Design requirements readily met

These difficulties may appear formidable in enumeration. But measurements which have been made of flatirons, toasters, waffle-irons, table stoves, vacuum cleaners, and so on through the list of articles which the modern housewife has at her command, indicate that the materials are available and the designers have the skill to produce devices in which the user is never once troubled by leakage currents. On the other hand, it is equally true that daily there are being sold devices which await only the proper combination of circumstances, often associated with a little carelessness—forgetting to disconnect the food mixer before grasping the water faucet to rinse off the batter, reaching out of the bathtub to turn off the radiant heater, pushing the vacuum cleaner under the radiator—to produce that unexpected paralyzing sensation of shock which, while usually not dangerous, results in an apprehensiveness associated with the use of electrical appliances that may cause the victim to use other and more laborious means of accomplishing the task rather than to return again to the device which produced the unpleasant experience.

Now there are certain electrical appliances in the use of which injury may result from carelessness or improper use, not because they operate with electrical energy, but because of high temperatures or high speeds, or for some other reason. The soleplate of an electric flatiron will produce a burn as promptly as a sadiron which has been heated on the gas range. It is possible for the user to receive injury from the ordinary electric desk fan, although it is much less probable than when he runs his own hand saw—and probably less serious. Such incidents represent simply the familiar hazards of modern life. They can be avoided by the exercise of a little care and their number per year is astonishly small.

But the hazards of deficient insulation are not so readily and completely avoidable. The device in which the insulating material absorbs moisture readily, or has low resistivity at operating temperature, or has been applied in such a way as to give high capacitance current, although otherwise of satisfactory characteristics—such a device gives to the user no outward sign of its hazardous condition, nor is the user ordinarily possessed of the facilities to measure the present value of its leakage current. Fortunately for the industry the general background of satisfactory experience which is associated with the use of electrical appliances has caused the user to approach electrical devices without apprehension on this score. But it must be conceded that this background is more the result of fortuitous circumstances than of studied care. Conditions in the home, with wood floors and dry, insulating floor coverings, and, until recently, with the majority of the household appliances, used in the dining room rather than in the kitchen or bathroom, must be held as largely responsible for the absence of shocks, rather than the adequacy of the insulation employed in the devices. Such favorable conditions should not and cannot be relied upon in the future. With growing appreciation of the merits of electrical appliances, established types are being used more and more in kitchens and kitchenettes, in close proximity to grounded water faucets, metal-covered tables and shelves. New appliances, such as the various motor-driven devices, are being rapidly developed for use in the kitchen. It would be idle, not to say discreditable, to admonish the user to keep away from grounded objects. Rather the industry must see to it that these household tools are made thoroughly safe under the less favorable conditions which exist in such places.

Good insulation can be obtained without high cost

Any problem met in providing adequate insulation arises in but small part from difficulty in securing materials of suitable characteristics. The solution need not result in high prices for satisfactory devices. It has been noted above that the presence on the market today of scores of well-insulated household appliances, at attractive prices, demonstrates that the problem is readily soluble. The presence of others, with evidences of careful design to give satisfactory performance, of durable construction and finish, but with insulation which can be characterized as no less than hazardous, can only be attributed to lack of attention to this aspect of the problem on the part of the producer. To continue to overlook this matter is to invite ultimately unfavorable public attention to the deficiencies of insulation in electric appliances, an attention which the wise designer will seek to anticipate and avoid. Can the industry afford to set for itself any lower standard than this, that the insulation of every household electric appliance shall be so satisfactory that it will not be possible for the user to experience any sensation of electric shock under any legitimate condition of use?

▼

Cost of Power House Crane

Detailed costs of purchasing and installing a 25-ton, four-motor, cab-operated traveling crane for the 13,200-kva. hydro-electric plant of the Connecticut River Power Company at McIndoes Falls have been compiled by the engineering staff. The crane has a span of 27 ft. 3½ in. and is equipped with two 12½-ton, three-phase, 60-cycle, 440-volt hoists. Erection was by company forces under factory supervision:

Labor		$ 509
Material—		
Crane	$6,000	
Freight	129	
Supervision of erection manufacturer	127	
Miscellaneous material	400	
Total material	$6,656	6,656
		$7,165
Total cost, per ton		287

Electric Furnace Cast Iron in the Detroit Territory

By H. J. HALL*
Detroit Edison Company, Detroit, Mich.

IN THE ELECTRICAL WORLD of January 21, 1933, Delton T. Waby very forcibly called to the attention of the electric utilities the potentialities of the electric furnace cast-iron load. Mr. Waby has shown that if all the cast iron produced in seven Middle West states were produced in electric furnaces the utilities would gain a load of 2,275,000,000 kw.-hr. annually. Even 20 per cent of this amount would be welcome as new business.

During the last three years the Detroit Edison Company has cultivated the field of electric furnace cast iron and has added a highly satisfactory load to its lines. Our studies of the field indicate that it has barely been opened, and developments in electric furnace cast iron already made, as well as other revolutionary developments which are in progress, promise large increases in load in the near future. Five foundries served with Detroit Edison power are using ten electric furnaces for cast-iron production and three foundries have purchased five units for experimental work. The production furnaces have a combined load of 4,650 kw. connected.

The U. S. Bureau of Commerce reports that a total of 460,255 tons of electric steel, for ingots and castings combined, was produced in the United States in 1931, the last year for which the summary is available. The fourteen electric cast-iron furnaces served by the Detroit Edison Company have an annual capacity of 19,200 tons of cast iron cold melted, or approximately 4 per cent of the total electric steel production in the United States in 1931.

In the Detroit *News* of February 12, 1933, appeared an article by H. T. Woolson, chief engineer of the Chrysler Corporation, which clearly shows the attitude of leading automotive engineers toward electric furnace cast iron. It is pointed out in this article that electric furnace cast iron is being used for automobile camshafts and is being further developed for automobile crankshafts, and that some automotive manufacturers are already using electric iron cylinder blocks. Other applications are common, and this modern, greatly improved cast iron is replacing steel forgings and steel and malleable castings. Electric iron manifolds, tappets, clutch plates are finding a place in the modern automobile, and a good portion of all brake drums used today are products of the electric furnace.

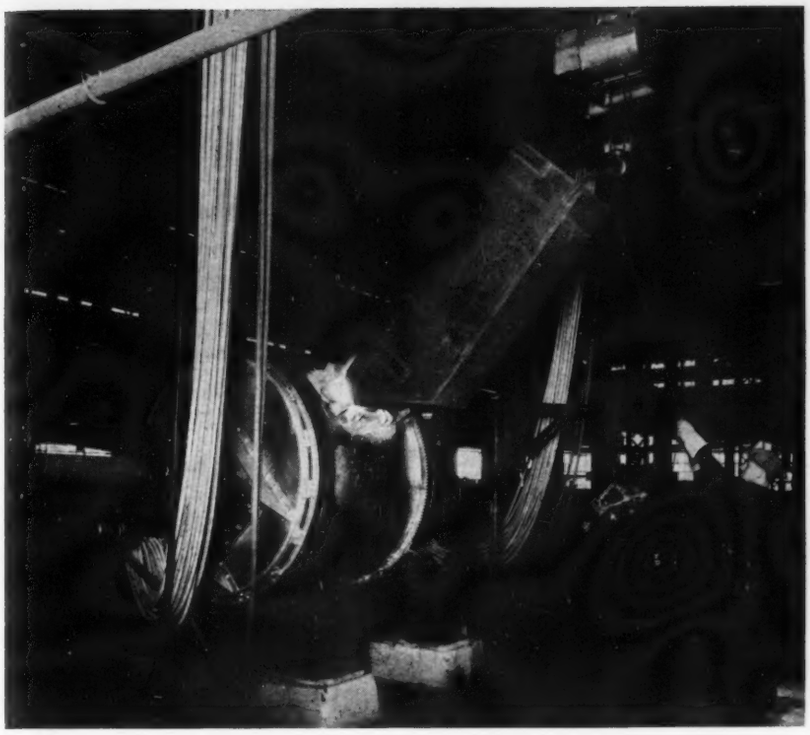
Cast parts equal to forgings in parts weight

Referring to Mr. Woolson's analysis of the materials used in a standard Dodge Six sedan, we find that 425 lb. of iron castings and 460 lb. of steel forgings are used. It is probable that most of the cupola iron castings and part of the forgings will be electric furnace iron in the near future. The average automobile production for the last ten years was, according to U. S. Bureau of Commerce statistics, 3,900,000 units per year. Assuming a future production of 2,500,000 cars per year and 500 lb. of castings per car, this industry alone will consume 625,000 tons of castings per year. This will require 893,000 tons of molten iron in the foundries

Pouring iron for brake drums

The largest electric furnace cast iron installation in the Detroit territory is in the foundry of the Cadillac Motor Car Company which contains four 7,000-lb. and one 300-lb. rocking indirect arc furnaces. They are used for cold melting, or for duplexing cupola iron, as requirements dictate. Each of the four large units can melt 2,000 pounds per hour and duplex from three to five tons per hour, depending upon the type of iron being produced. The iron from these furnaces is used for pistons, brake drums, clutch plates and miscellaneous other castings that require high quality. The small unit is used for melting special alloys and for experimental work.

**Paper presented at American Foundry Association Convention, Chicago, June 19-22, 1933.*



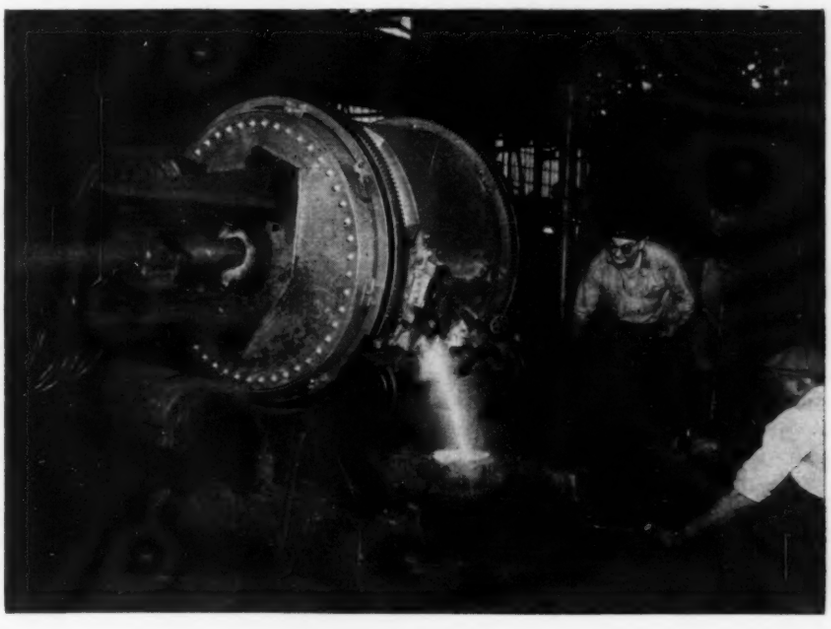
Charging cold scrap

The Eaton-Erb Foundry Company, a division of the Wilcox-Rich Corporation, has an electric furnace installation producing piston rings, valve tappets and miscellaneous other castings. A considerable portion of the output is produced in permanent molds, in which work the company specializes. Permanent mold iron castings require most rigid control of composition. The installation consists of a 7,000-lb. and a 400-lb. rocking indirect arc furnace. The former is used for duplexing cupola iron and cold melting as required and the latter for cold melting for small production requirements and for development work. A similar installation (illustrated herewith) is in the D. J. Ryan Foundry Company, Ecorse, Mich. A 7,000-lb. rocking furnace is used for cold melting and duplexing for automotive and machinery castings. Brake drums, manifolds and cylinder blocks are being produced and this foundry is prominent in the development of the high-strength iron used for camshafts and crank shafts, as well as in the production of wide variety of heat-treated irons, special alloy irons and malleable. The 400-lb. furnace shown is almost exclusively devoted to this highly special work.

supplying these castings. Of this amount possibly 65 per cent, or 580,000 tons, will be duplexed and 313,000 tons cold melted from scrap. Assuming an average energy consumption of 100 kw.-hr. per ton of duplexed and 600 kw.-hr. per ton of cold melted, the potential annual energy consumption is 245,000,000 kw.-hr.

It should be pointed out here that the consumption of electrical energy is not confined to melting and duplexing alone. Many of these electric furnace iron castings are being heat treated. Electric furnace cast iron of high physical strength has been developed and ultimate tensile strength values exceeding 100,000 lb. per square inch will be common. Such properties depend not alone upon proper melting methods, but also upon proper heat treatment, and it is fortunate that the electric heat-treating furnace best offers the refined degree of control of temperature and atmosphere that is essential for this material.

The electric iron furnaces in the Detroit territory are, as might be expected, devoted largely to the production of automotive castings. While automobiles will undoubtedly consume tremendous tonnages of electric cast iron, the uses of this new engineering material are by no means confined to the automotive industry. Another rapidly developing industry gives promise of consuming large tonnages of electric furnace castings. This is the refrigeration and air-conditioning industry. Refrigeration designing engineers already have discovered that the electric furnace produces castings that are stronger, machine more easily and contain fewer defects.



Castings for twelve-hour delivery

An unusually interesting installation is in the Atlas Foundry Company, Detroit. This jobbing foundry specializes in automotive castings and supplies many intricate and unusual castings for a wide variety of uses. With this electric furnace the Atlas company has developed its business to produce castings made to specifications requiring accurate control and with less than twelve-hour delivery. It is a 1,000-lb. Detroit "Rocking" electric furnace and is used for cold melting and duplexing.

Wholesaling for Profits

By L. W. W. MORROW
Editor ELECTRICAL WORLD

Manufacturers say jobbers cannot sell. Dealers say wholesaling is unnecessary. Wholesalers ask for a chance to sell. Opinions vs. facts.

YOU will get into plenty of hot water if you discuss the jobber. This was the frank opinion of manufacturers, jobbers and dealers. But perhaps this advice is the best proof that the jobber situation needs discussion, in order that a presentation of opinions may lead to constructive thought and action.

Ask the manufacturer about the jobber and too frequently he replies: "The jobber doesn't sell. He is a warehouseman and an order taker for supplies. He does no creative marketing and cannot sell major appliances and engineering equipment. He complains about his discounts and yet waits for us to develop and sell his markets. He would be a failure if he attempted to sell such products as ranges, refrigerators, meters, motors and controls."

Ask the contractor-dealer about the jobber and he frequently replies: "We don't need the jobber any more. He just takes a discount on the business we sell. We don't even need his warehousing as the manufacturer and the mail order houses now have warehouses. The jobber too frequently sits down with the district manager of the manufacturer and these two try to get all the good accounts. We believe we can do the local market selling best by dealing directly with the manufacturer. We can even buy our supplies cheaper from some of the manufacturers and the mail order houses than from the jobbers. Why is a jobber necessary these days?"

But of course the jobber has a comeback: "We don't get a chance to sell. The manufacturer sells directly to mail order houses, utilities, large industrials and to dealers. The manufacturer even sells some of these people quality supplies at lower prices than we get. He also introduces and sells lower quality supplies at still lower prices, yet demands that we handle his superior but more expensive line. Many contractor-dealers buy their supplies from the mail order houses now to save money and some of the manufacturers are giving to dealers our discounts on motors and other devices. We are supposed to warehouse, extend credit, make collections and do creative selling on a small margin. We are supposed to 'lay off' many customers so that the district office or a manufacturer's agent may sell them. In addition, now we have this new thing called a 'distributor' to contend with. Many of us are owned or dominated by the manufacturer and are forced to carry out his policies, however incorrect they may be. I insist that the jobber can sell if he is given the chance. Our problem is to get the manufacturer and retailer to grant us an opportunity to show that we can and will perform the wholesaling function. We know that this function is a needed and economical aspect of distribution."

Thus, disparaging remarks, mutual recriminations and diverse opinions exist in regard to wholesaling, and the present thin market aggravates the normal chaos. What is the background for these opinions and for the present trade practices?

Shifts in wholesaling conditions

Without going back to prehistoric times, it may be said that the jobber grew up in a local market area as a necessary element of distribution. He sold all kinds of electrical equipment to customers and to dealers. He developed warehousing, he extended credits and he made collections. He studied his local markets and sold them with the aid of his affiliated dealers. But this happy day ended with the advent of national distribution and direct selling by manufacturers. The larger manufacturers established district offices to sell engineering equipment and distributors to sell appliances. They bought or dominated many of the local wholesalers and restricted their sales to supplies only. Other local wholesalers became part of a national wholesale organization. *National distribution with manufacturing domination and direct selling changed the scene.*

Thus, during the past decade the jobber became primarily a wholesaler of electrical supplies. He became a warehouseman more or less and in self-defense tried to sell lines made by all manufacturers. He extended credit and he made collections in a fringe market only. His salesmen covered wide areas and were order takers for supplies. His best customers were gradually taken over and sold by district office salesmen, manufacturers' agents or mail order houses. The affiliated customers and dealers deserted the wholesaler because of better prices offered by the producers.

Yet in the past decade, because of the great volume of wiring and industrial electrification, the electrical wholesaler existed because of the business that came to him or was sold by him. When the supply business tapered off the wholesaler rode on the radio wave into the Coolidge boom which brought more business. But now all is changed.

Wiring and industrial electrification is not a demand business in large volume. The markets are thin and the competition keen. The profit margins on standard supplies are small. The important function of the wholesaler today is selling—not warehousing. The wholesaler must make market analyses and do creative selling. *He must sell supplies as the grocer sells sugar and make his profit on other lines.* He must perform the complete function of local market wholesaling, including market creation and the development of dealer aids and sales programs. He must have the aid of the manufacturer and the dealer in the determination of his field of action, and this must be based on the fact that he can do the work best and most economically. The wholesaler may have been slow to recognize the changes that have oc-

curred, but he is more cognizant of them today than the manufacturer.

Blames the manufacturer

One wholesaler puts it this way: "The obstacles which confront us are due chiefly to the fact that the electrical manufacturer tries to apply past thoughts to present conditions. It is my observation that the manufacturer lacks a definite objective; that he does not know what he is trying to do. Furthermore, he does not know how to sell. He has a vacillating policy and is continually experimenting with distribution. He has no data on distribution costs and no conception of sales cost analysis. In some territories he has too many distributors competing between themselves on his lines; in others he is selling in competition with the wholesaler through manufacturers' agents and through direct sales to customers. His sales department lacks a knowledge of his markets and is not equipped to aid his wholesalers in doing a constructive selling job. It is not uncommon for manufacturers to attempt to steal their competitor's wholesalers by the use of confidential discounts, special deals, etc. In addition, we have the 'gyp' manufacturer, whose only object is to get business by underselling or by putting out substandard products."

Typical sources of trouble

One aspect of the jobbing situation is the tendency of manufacturers to establish too many jobber outlets. Jobber discounts are made to dealers, hardware stores and even to plumbers in small towns. Then, again, the schedule goods manufacturers trespass upon former sources of jobbing business. Jobbers formerly sold radio and fixture manufacturers their cords and wiring devices, but the recent trend is for the schedule goods manufacturers to sell these small resale manufacturers direct. Even in the panelboard business there is an increased tendency toward direct selling and toward asking the jobber to handle the billing so that the prices will not appear on the manufacturers' office records. In several instances base prices have been quoted customers by the manufacturers on the plea that the jobber had done no work on behalf of the manufacturers and that the base price was necessary to get the business.

One of the very bad situations comes about through the use of manufacturers' agents by small and medium sized manufacturers. These agents are on a commission basis and depend upon direct orders for their living. They do not use or cultivate the resale channels, but deal with buyers directly. They frequently take dealers and put them on a distributors' discount basis. Reflectors and flood lights are typical products sold by manufacturers' agents directly by by-passing the usual resale channels. Another bad development in a thin market comes from the wholesaler giving away his spread to retailers. He will make a close margin set-up with a dealer in a town to get business at little or no profit. Then, again, the larger contractors have taken pleasure in pinching the jobbers. They like to play with the bigger jobbers and never hesitate to use as a lever to get lower prices any manufacturer or manufacturers' agent who will sell them directly.

In some instances the manufacturer takes advantage of his owned jobber to sell direct. One typical example was a small motor order to a small industrial plant. Bids at list from several competitors were around $800, but one manufacturer through his owned jobber quoted a direct price of $500 and got the order. In this thin market standard practices go by the board—the business must be had.

An Example for Manufacturers to Follow

STATEMENT OF SALES POLICY

1. **Milford and Mil Flex** hack saw blades are sold exclusively through distributors and jobbers in various channels of distribution in territories where representation is established. Direct inquiries and orders are referred to these representatives.
2. **Milford and Mil Flex** hack saw blades are not sold direct except in territories where representation has not been established. Such direct sales are made at resale prices enabling nearby distributors and jobbers to compete.
3. **Milford and Mil Flex** hack saw blade orders from non-stock carrying dealers are referred to representative distributor or jobber in territory where order originated.
4. **Milford and Mil Flex** hack saw blades are sold under a nationally announced discount, without rebates or special concessions of any description. The same discount is given all representative distributors and jobbers stocking these lines.
5. **Milford and Mil Flex** distributors and jobbers are discriminatingly selected and limited in number in a territory. Exclusive representatives are appointed when local competitive conditions and size of territory warrant.
6. **Milford and Mil Flex** hack saw blades carry an announced resale price that provides an adequate margin of profit to distributor and jobber. Price cutting is vigorously discouraged.
7. **Milford and Mil Flex,** other factory, special or private brands of hack saw blades, are not sold through any one channel of distribution at prices lower than quoted representative distributors and jobbers in all channels of distribution. If manufactured, special grades of hack saw blades, or their equivalent, will be available to representative distributors and jobbers in all channels of distribution at the same prices and terms.
8. **Milford and Mil Flex** hack saw blades are sold on terms of 2 per cent cash discount, 10th proximo, or net thereafter. Freight is allowed on shipments of 100 lb., or over.
9. **Milford and Mil Flex** hack saw blades are guaranteed against defective workmanship or material, and if found defective or unsatisfactory, a fair and equitable adjustment or replacement will be made. Upon authorization all unsatisfactory blades must be returned to the factory for inspection.
10. **Milford and Mil Flex** distributors and jobbers are given direct mail literature, price lists, catalog help, sales promotional assistance, technical and engineering advice, factory representative contacting with consumer and educational assistance.

At the request of any distributor or jobber representing these lines, we will disclose our discount schedule in substantiation of our nationally announced price policy.

THE HENRY G. THOMPSON & SON CO.

An interesting phase of the jobber business deals with appliances. Some appliance manufacturers specialize on direct selling to utilities, some use the jobbers and others sell directly to dealers. A recent development is the use of the "distributor," a new name for a specialty appliance jobber who concentrates on major appliances. The result is more or less chaos, with the jobber becoming less important in appliance sales. He is restricted to selling the smaller appliances, in large measure.

On the other hand, it is worthy of investigation to learn whether the jobber might not have an appliance department, with the equivalent of a specialized appliance distributor in charge, so that advantage might be taken both of multiple selling and the jobbers' intimate and continuous relationship with local market conditions. As public acceptance gains on a major appliance and competition forces down prices and margins the jobber, with an appliance department, can adapt his business more readily to the changed conditions than can the specialty distributor. It may also be noted that the development of local co-operation between utilities and dealers makes it possible for the jobber to have a more dominant influence in local appliance sales and market development—all local outlets must buy as well as sell on the same basis.

Engineering product sales

In the sale of engineering products, such as motors and control, the shift has been from the jobber to direct selling by the manufacturer or his agent. It is claimed that engineering selling cannot be done by the jobber and that the wholesaling margin puts too much of a burden on prices as well as interposing an unnecessary link in the distribution chain. With the depression, however, comes another shift, because direct selling cannot be supported. An endeavor is made therefore to set up the contractor-dealer as an industrial specialist on engineering products. He is given the discounts and sales aids and reports directly to the manufacturer.

The manufacturers claim that history shows that the jobber does not develop dealers and that the jobber is a tonnage operator who depends upon coverage with standardized products to earn a profit. The jobber cannot afford to specialize, and if he does his selling expense will approximate that of the manufacturer working directly with dealers. The manufacturers, therefore, believe they should work directly with the dealers to develop them into specialists on sales of engineering products. Thus engineering product selling is developing along lines of a small industrial specialist jobber who also may have a contracting department, the development of the contractor into a specialist jobber and the development of a specialist distributor or manufacturers' agent.

Once this takes place chaos occurs, for other manufacturers try to make these specialists their distributors and give them jobbers' discounts on wire and pipe, for example, and these favored contractors or distributors have a favorable position with respect to competition with other contractors for business. Also, the discount situation is turned into chaos and the inevitable trend is a complete breakdown of jobber distribution for engineering, supply and construction materials. Inevitably, however, the wholesaling function will be rebuilt, for any local market area needs both the wholesaling and retailing elements of distribution.

The Electrical Wholesaler's Position in the Industry

A declaration adopted by the National Electrical Wholesalers Association at its 24th annual convention, Buffalo, N. Y., September 28, 1932.

The electrical wholesaler is an integral part of the Industry because of the economic service which he performs for the other branches as a distributor of electrical supplies and merchandise.

The electrical wholesaler conceives it to be his duty:

1. To maintain and warehouse an adequate stock of standard commodities sufficient to supply his trade.
2. To maintain a showroom properly to display commodities for the benefit of the trade.
3. To maintain store facilities for pick-up service.
4. To maintain a selling organization trained to promote, specify and quote on electrical commodities, and properly to handle matters of service or misunderstanding with customers.
5. To be prepared to furnish promptly a great variety of electrical commodities in one order at a minimum of cost and with greatest convenience to the trade.
6. To advise the trade regarding the most suitable and reliable commodities to purchase and install.
7. To distribute catalogs showing and describing the most essential items in common use in the industry.
8. To extend justified credit to the buyers within his territory upon reasonable terms.
9. To maintain a repair and replacement service to supplement the facilities of the manufacturer and the retailer in the handling of defective commodities.

The logical development, therefore, is for the jobber to departmentalize and put competent man-power in charge of the sales of engineering products. Follow this with classification of accounts to fix jobber direct sales and the economical accounts for specialized dealer sales. The jobber can meet the shift in distribution only by proving his competency to make his sales and to develop dealers who can make their sales. *Changes in names and distribution methods will not eliminate the principle that both wholesaling and retailing are economical steps in distribution when a complete analysis of costs and returns are had based upon selective marketing and multiple selling.*

"But there are obstacles within the wholesaling industry also," an experienced wholesaler stated. "In the final analysis the independent wholesaler, who comprises two-thirds of the industry, is most influential for controlling the market. If the independent wholesaler is to operate at a profit, then the three national houses must operate upon a basis that permits the independents to compete with them on an equal footing so that each group may have its fair share of the market. At present the national houses sell in a most unorthodox fashion in many instances. They wield the club of reciprocity on the least provocation and appear not to care how they sell so long as they get the business."

Wholesalers state obstacles

Thus, from the point of view of the wholesaler, his troubles appear to be:

1. Lack of a proper conception of the wholesaler's function, especially on the part of the manufacturer.
2. Inadequate margins of profit.

3. Price cutting, because of lack of a knowledge of selling costs by both manufacturers and wholesalers.
4. Over-distribution by many manufacturers.
5. Direct selling by manufaturers in competition with their own distributors.
6. Profitless forcing of the markets and wide use of reciprocity by the national houses.

Progress has already been made to correct the conditions. Some of the tangible requirements are:

1. A clearer conception by the entire industry of the function of the wholesaler. These functions have been defined by the National Electrical Wholesalers Association in general terms.
2. Manufacturers should decide upon and state definitely their distribution policies and should follow these policies.
3. Wholesalers should work in their own group to eradicate price cutting, to educate the manufacturers as to the evils of over-distribution, excess direct selling, competition with their own distributors and vacillating distribution policies.

During the past two years local groups of wholesalers, more or less informally, have done good work along these lines. In addition they serve as clearing houses for credit information and the disposal of overstocks. These local groups should be formed in each major trading area and the national association can help in this work, especially if the industrial recovery act passes Congress.

Must earn their position

Wholesalers must earn their position and must establish profitable operations. They must apply the principles of selective marketing and multiple selling so that they sell profitable commodities to profitable accounts. They must obtain reliable data on costs and markets in order to apply principles accurately. Studies must be made by invoice lines, by commodities, by customers and by salesmen's territories and cost accounting systems must then be established. The manufacturer is just as interested in these things as the wholesaler. It is an industry job.

The conception of the wholesaler as a seller of supplies is too limited. But both man-power and education will be required for the wholesaler to become competent to sell appliances, supplies, construction material and engineering apparatus. The jobber will have to specialize and departmentalize as well as add competent men to his staff in order to sell other lines. He did this once, but has forgotten how. The wholesaling function must be established upon a factual basis, and undoubtedly the wave of direct selling by manufacturers is receding so that the wholesaler can come into his own in the coming years. Generalizations are unsafe, but it appears logical to predict a greater service and a larger business for the wholesalers in the future.

Local area work advocated

One definite suggestion is for wholesalers in each local area to organize and to work out their own salvation based upon sound principles and local facts and conditions. Some of the things to consider immediately are:

1. Extent of co-operation of chain wholesalers.
2. Degree of centralization of authority and for statistical compilations and cost accounting.
3. Number of wholesalers needed.
4. Method for independent wholesalers to obtain a complete line by affiliation with several single product manufacturers.
5. Establishment of sales functions of manufacturer, wholesaler and dealer in the area.
6. Sales aids and market development programs for wholesalers and their dealers.
7. Clearing house on credits and stocks.
8. Local code of sales ethics and practices.

Distribution is too complex to permit of generalizations. The national associations of each group can only state principles and encourage work in each local trading area to carry out these principles in terms of practical business conduct. If these local groups get together, assume power and are strong, fair minded and act in unison they can dictate their own policy—they control the local market.

Opinions can be displaced only by facts and adequate data on distribution sales costs are essential to manufacturer, wholesaler and dealer before their respective practices can be established on a tangible basis. All elements should unite to get these facts. The wholesaler in today's market is a factor in the distribution system that should be handled on a factual basis. Facts are missing, and that is why such differences of opinion and practice exist.

▼

Big Losses in Furnace Electrode Joints and Clamps

Investigations of electric furnace electrodes reported recently before the Electrochemical Society by Bruce L. Bailey and Raymond R. Ridgway indicate that the surface temperature of electrodes and the resistance of their joints and terminal contacts must be given major consideration if the most satisfactory performance is to be obtained.

When the surface temperature of either carbon or graphite electrodes reaches 500 deg. C. oxidation is rapid and the cross-section and consequently the permissible current-carrying capacity are rapidly reduced.

Unless precautions are taken to hold down the resistance of screw-threaded joints and electrode contacts the power losses may become excessive. Tests indicated that the maximum surface temperatures occurred at joints. Higher permissible current densities can frequently be obtained merely by lowering joint resistance. High-conductivity graphite nipples or all-graphite assemblies improve joint resistance characteristics appreciably. The character of the joint compound is also important. When the joint is assembled it must be well filled with compound, the nipples accurately fitted and sufficient pressure applied to secure a good contact.

The power loss at electrode clamps may offset the savings attainable by using high-current-density electrodes, the authors declare, unless the contact resistance is held down. A bronze clamp lining which yields to the shape of the electrode has been found considerably superior to an unlined steel clamp in this respect. The resistance of the electrode clamp contact may be more important than that of the busbars and electrodes, yet it is often overlooked because of water cooling.

High-conductivity carbon electrodes are superior to standard carbon electrodes in current-carrying capacity, but not comparable to graphite. Tests indicated that a 7-in. graphite electrode is almost directly equivalent to a 12-in. ordinary carbon electrode. Based on a maximum surface temperature of 500 deg. C. it was found that graphite electrodes have a permissible current density of 143 amp. per square inch; high-conductivity carbon, 65-72, and ordinary carbon, 48-49. The losses per foot of electrode assembly ranged from 2.6 to 4.2 kw.

Unsymmetrical Regulation Works Well With Rural Feeders

By H. B. PHELPS
Assistant Division Engineer
New York Power & Light Corporation, Glens Falls, N. Y.

THE idea has been suggested, but not widely executed, that the voltages of a three-phase rural feeder be unbalanced and that the load be divided into three groups, connected successively to the low-, intermediate- and high-voltage phases. It is apparent that the method is not applicable to feeders serving three-phase loads. In many cases, however, the third phase is added, not to operate induction motors, but solely to improve the line regulation. In such cases, when the use of regulators is at all necessary, the "unbalanced voltage" or "phase-grouped" method is always preferable.

The salient feature of this plan is that the range of voltages delivered to customers is about one-third of the actual line drop (Fig. 1). The ideal load distribution, which gives the unbalanced-voltage line this advantage of three to one over the balanced three-phase line, does not always prevail. In practice, the unbalanced-voltage line is at least 2½ times as good as a similar three-phase line, or five times as good as a single-phase line.

In view of this fact it is interesting to compare a 4.6-kv. unbalanced-voltage three-phase line with a 13.8-kv. single-phase line. We find that:

1. The cost of transformers, with cutouts and lightning arresters, per installation is $100 greater for the 13.8-kv. line.
2. The cost of wire and insulators per mile is $140 greater for the 4.6-kv. line. (Using No. 2 A.C.S.R.)
3. With the same size conductor, voltage regulation of the 13.8-kv. line is about 1.8 times as good as that of the 4.6-kv. line.

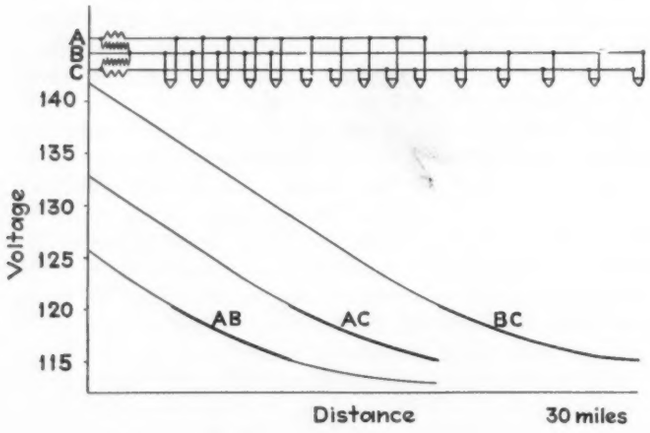


Fig. 1—Regulation improved by unbalancing phase voltages

The shaded sections of the voltage gradients represent voltage actually supplied to customers. This line is 30 miles long, 4,800 volts, No. 4 copper, and the load is 150 kw. in three groups of 50 kw. each. The maximum voltage on *BC* phase is 144 (secondary scale). The range of voltages actually supplied is 116 to 122.

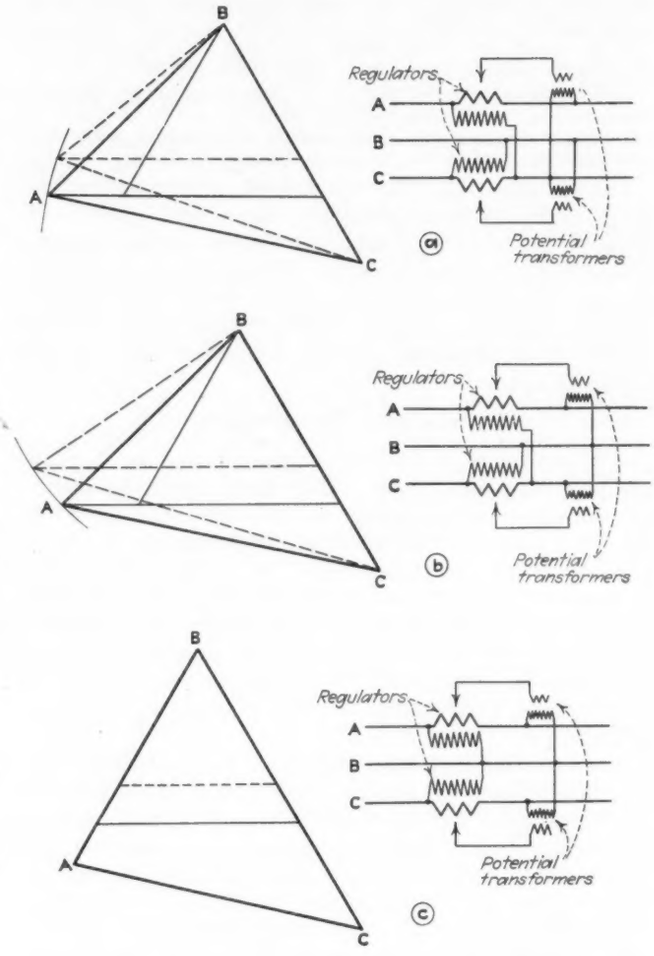


Fig. 2—Conventional regulator connection more satisfactory than special connections

(a) and (b) In either case of special connections one phase voltage varies with bus voltage. (c) In regular connection all phase voltages are independent of bus voltage

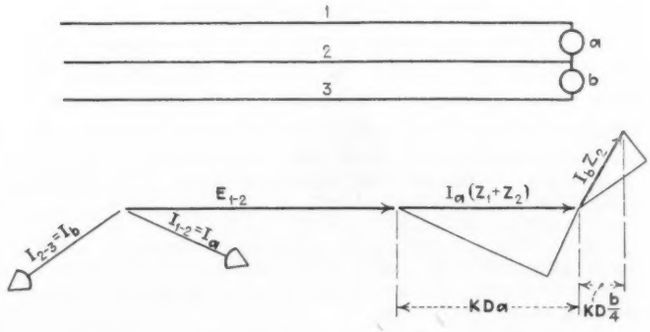


Fig. 3—Assumption of balanced angles simplifies calculation of voltage drops and settings

4. When there are three or more transformers per mile, the saving in transformer costs makes it possible to increase the conductor size of the 4.6-kv. line, so that its effective voltage regulation is better than that of the 13.8-kv. line, and still keep a lower total cost per mile.

Unbalance derived from compensator settings

If the source of power is unregulated (as a substation bus) the diagram of Fig. 1 is applicable as shown. Two regulators are used, one in the high- and one in the low-voltage phase, the different voltages being obtained by the respective compensator settings.

If the rural line originates at the load center of a balanced urban feeder only one regulator is required. This is connected in the high-voltage phase (*BC* in Fig. 1). The same operating principles apply as when two regulators are used and calculations for the two cases are similar.

The unbalanced-voltage plan is described in the General Electric Company's Regulator Handbook and a special regulator connection is suggested, having the potential lead of one regulator crossed over to the opposite regulated conductor. The advantage of this connection is that standard 10 per cent regulators can boost the voltage of the "high" phase up to 15 per cent. It should be noted, however, that 15 per cent is not usually enough for the purpose, and also that this connection cannot give accurate regulation. In Fig. 2 (a) and (b) show how, with this connection, no matter which two phases are controlled by the potential transformers and contact-making-voltmeters, the voltage of the other phase will vary with bus voltage. In view of this fact, it is advisable to use the conventional hook-up, with a high-boost regulator or a static booster in series in the high-voltage phase.

One difficulty, which has probably retarded the general use of this method, is that of calculating the voltage gradients in each phase so that the transformers may be properly allocated and the performance of the line accurately predicted. A short-cut method has been developed which is peculiarly adapted to this problem.

The method is based on the use of a "kilowatt-mile" table or chart, such as here reproduced (in abridged form):

Line Regulation in Secondary Volts per 100 Kilowatt-Miles

4,800 Volts, One-Phase, 30-In. Spacing

Wire Size, AWG.	Power Factor 0.80	0.90
6	2.83	2.55
4	1.96	1.73
2	1.42	1.19
00	0.95	0.74
Corrections		
59 in. spacing	+ .06	+ .03
88 in. spacing	+ .10	+ .05
ACSR equivalent	— 0.02	— 0.01

The voltage drop $V = K\ D\ P$, where
V is in volts, secondary scale.
K = constant from the table.
D = distance in miles.
P = hundreds of kw.

For three-phase circuits K would be one-half the above values. For solving the unbalanced circuit we use the single-phase K and work each phase separately.

The drop in 1-2 phase includes two components, due to loads "a" and "b" respectively. The drop due to load "a" is

$$V_a = K\ D\ a$$

The drop due to load "b" is only one-quarter of the product $K\ D\ b$, because the vector $I_b\ Z_2$ is at an angle of approximately 60 deg. to the voltage E (as shown in Fig. 3 for a three-phase circuit feeding two single-phase loads); moreover, the current traverses only one conductor of 1-2 phase. Therefore

$$V_b = K\ D \left(\frac{b}{4}\right)$$

and the resultant drop in 1-2 phase is

$$V = K\ D \left(a + \frac{b}{4}\right)$$

Similarly, the drop in 2-3 phase is

$$V = K\ D \left(\frac{a}{4} + b\right)$$

and that in 1-3 phase is

$$V = K\ D \left(\frac{a+b}{4}\right)$$

In other words, the drop in any phase may be calculated on the basis of the load connected to that phase, plus one-fourth of all the load on other phases.

An inaccuracy in the above theory will probably occur to the reader. The assumption is made that the vector $I_b\ Z_2$ is at 60 deg. to E. This, of course, is not necessarily true. It will be found, however, that in the circuits to which phase grouping is applicable the assumption is justified. The combination of a high ratio of resistance to reactance, with a good power factor, makes the vector drop nearly in line with the voltage applied to the load. Also, the error is compensated for when all phases are loaded, becoming zero in a balanced circuit, as shown:

Using the three-phase K, for balanced loads,

$$V = K_{3\text{-phase}}\ D\ (a + b + c)$$

By the short-cut method, for unbalanced loads,

$$V = K_{1\text{-phase}}\ D \left(a + \frac{b+c}{4}\right)$$

Putting $a = b = c$, and $K_{1\text{-phase}} = 2\ K_{3\text{-phase}}$, the above expressions become identical.

Cut-and-try procedure not difficult

In setting up the "phase balance" or allocation of load between phases, a cut-and-try process must be used. The general procedure is:

1. Make a tentative layout, with the farthest load group on the high-voltage phase, etc.
2. Locate the three load centers and estimate the magnitude of each load group.
3. Calculate the drop in each section, each phase separately, by the short-cut method.
4. Draw the three voltage gradients on cross-section paper, not overlooking the fact that they are interdependent at the source.
5. By inspection of the gradients, revise the phase balance, so as to get as nearly as possible the same range of voltages in each phase group.

The voltage gradients will show the amount of "boost" to be expected from each regulator. It will probably be necessary to use a 20 per cent regulator, or a static booster in series, in the high-voltage phase. The current transformer for this phase must have as low a ratio as possible, otherwise the high compensation required may be outside the range of the standard 24-volt compensator. For the same reason the compensator should be connected on the 5- instead of the 8.66-amp. tap.

In adjusting the compensator the R lever only is used, the X lever being left at zero. This simplifies the calcu-

lation of the setting and improves the accuracy of the regulator action. The current from the middle load group would act directly on reactance compensation, regardless of power factor, and it is preferable that the furthest load have a predominating influence on the regulator action.

The installation is further simplified, if two regulators are used, by omitting the third current transformer or equivalent "phase-shifting" transformer. This device, in a conventional set-up, improves regulation by making the controls sensitive to unbalanced single-phase loads, on the assumption that the load-center on all phases is at the same distance from the regulator.

In this set-up the regulator on the high-voltage phase should respond to changes in the farthest load, but be as insensitive as possible to load on the two other phases.

The accuracy of the regulator action is therefore improved by omitting the third current transformer, and if an existing installation is to be revamped this current transformer should be removed or shorted. The installation thus reduces to two independent single-phase units.

The compensator settings may be calculated in advance, to minimize readjustments in the field. The in-phase component of the load current may be calculated from data already assembled. The desired compensator effect is the difference between full-load regulated voltage and the contact-making-voltmeter setting. Knowing that the compensator effect equals the compensator setting when the current transformer is fully loaded, the proper setting may be calculated by direct proportion. Expressed algebraically,

$$\frac{V}{V_c} = \frac{I}{I_c}, \text{ where}$$

V = compensator effect = (regulated voltage) — (CMVM setting)
V_c = Compensator setting
I = in-phase component of load current
I_c = C.T. rating, or ratio times five.

▼

Protection of Idle Machines

What precautions should be taken with rotating-type equipment (such as generators, frequency converters and synchronous condensers) when it is out of service for extended periods?

Practice of operating companies indicates that prevention of accumulation of moisture on the windings and maintenance of a satisfactory insulation resistance are the major consideration. Many depend on keeping the building in which the equipment is housed above a temperature where condensation can occur, or cover the units with tarpaulin and place space heaters or incandescent lamps in the air ducts. Next in preference seems to be the practice of running the machines at intervals of a few days to two months under light load, full load or short-circuit conditions. A few circulate current through the windings or blow hot air into the machine for a few hours each day. Where the inclosure of the machine or a covering will make the method effective, some moisture-absorbing chemical like calcium chloride or calcium oxide is sometimes placed where it will dehydrate the air in contact with the windings. Sealing of air chambers and draining air washers and cable tunnels are considered advisable by some companies where equipment is idle for long periods.

To keep a check on moisture absorption the windings are meggered periodically, although a few companies do so only before putting machines in service.

To keep bearings in an operating condition and in the case of turbo-generators to prevent distortion of the shaft the rotor is usually turned over occasionally. Where it is not feasible to run the equipment, a crane is used to turn the shaft. Some companies keep the bearings filled with oil and others drain and flush them monthly.

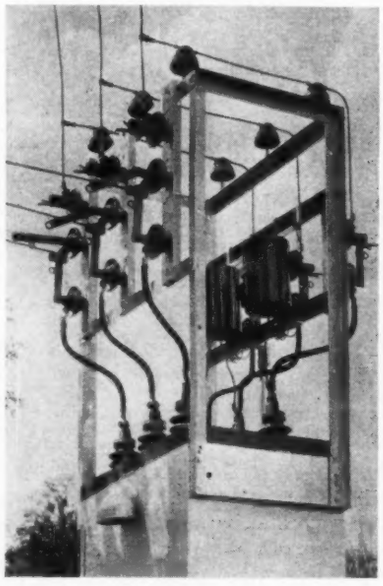
Corrosion of bright metal parts is usually prevented by applying grease, vaseline or tallow. Other metal parts are sometimes cleaned and painted and windings varnished. Brushes are often lifted or removed, the collector rings or commutator greased and in some cases wrapped with paper or cloth. Some cover idle machines with canvas or a fire-resisting cloth to avoid dust.

▼

Inexpensive By-pass Facilitates Outdoor Switch Inspection

By W. L. GARLINGTON
Florida Power Corporation, St. Petersburg

Frequent thunderstorms on the system of the Florida Power Corporation cause such damage and number of switch operations that the company has found it desirable to remove all equipment possible from automatic outdoor switch houses and provide them with by-pass switching equipment. It was found particularly desirable to replace the indoor potential transformers with the outdoor type, since the indoor type often flashed on a surge and started an arc that quickly spread and resulted in the loss of other equipment in the switch house. The by-pass equipment was desired in order to make possible a periodic inspection of the switch house without an interruption to service.



Switch readily by-passed without interruption

A light steel structure was mounted on top of the switch house and on this the by-pass switching equipment and outdoor potential transformers were mounted, resulting in a compact unit that can be easily moved from place to place.

The accompanying illustration shows clearly how the desired changes were made in an economical way. Switch house failures have shown a marked decrease.

Ice formations disclose serious leaks on the Upper Salida penstock

By L. M. ROBERTSON
Transmission Engineer
Public Service Company of Colorado, Denver

Improving Operation of Small Hydro Plants

Modernization proves an effective economy measure.
Engineers improved the property and reduced expenses without reducing personnel

IN A modernization program which included semi-automatic control and other new equipment for three of its small hydro-electric plants the Public Service Company of Colorado has found it possible to improve operation, increase both output and system capacity and reduce expenses without eliminating men from employment. The Salida hydro plants, herein described, were selected as typical of the improvement possible through an intelligent rehabilitation program. These plants, No. 1 (Upper Salida) and No. 2 (Lower Salida), form a part of the Salida-Alamosa system shown in Fig. 1. This system is composed of 44- and 16.5-kv. lines, the capacity of these hydro plants being quite a factor in its operation and therefore reliability is important.

Both plants are located on the same stream, the discharge from the upper station emptying into the forebay of the lower plant. The upper plant was built in 1905 and had a capacity of 440 kw. Plant No. 2, built in 1900, can develop 558 kw. Prior to the rehabilitation program both plants had an installed capacity of 600 kw. and were operating purely on stream flow, which meant that in the winter time, during the system peak load, they could not develop their maximum output because no storage facilities were provided. Since the plants are located high in the mountains, near the headwaters of the streams, the flow of the creeks becomes quite small in the winter.

Plant No. 1 takes water from two sources, the South Arkansas River, from which water is diverted by a 5-ft. concrete dam, and carried by a gravity pipe to the concrete diversion dam on Fooses Creek, which is the second source of supply. This diversion dam was a concrete wall 8 ft. high. Both dams were in very poor condition and required rebuilding. The gravity line and penstock to the plant were second-hand pipe when originally installed and were in such bad condition that repairs were impractical. Leaks in the pipes were becoming very serious and so numerous that the loss of water was a serious item. In the winter time ice formations reached large proportions and caused considerable trouble. The old waterwheels were Hug and De Remer units, manufactured in Denver years ago. The efficiency of these units was very low and bucket failures occurred frequently. Plant operators were working on twelve-hour shifts at both plants. From the above description of conditions it is evident that some steps had to be taken to remedy the situation.

Leaks stopped, units replaced

In 1928 a section of the penstock developed such a serious leak that immediate action was taken to replace this part. At this time a six-year program of replacement was decided upon which could be carried out by a small crew of men already on the payroll and used for such work at various properties. This avoided building up a large force and then cutting it down in a short time, as construction work in high altitudes can be done only during the summer months. Late in 1929 a new turbo-generator set of 750 kw. capacity was installed to replace one of the old units at plant No. 1.

At this time automatic control of this unit was installed with starting, stopping and loading of the machine remotely supervised from the lower plant. Protective features of this installation included shut-down in case of a.c. overcurrent, machine overspeed, overvoltage, incomplete start, low oil pressure, overheating and field failure. When an impulse is given from the lower plant over the control wires to plant No. 1 the valves are automatically opened, the machine started up and automatically synchronized on the line. Opening

the control circuit will automatically shut down the unit and close the valves. Governor control also is obtained at the lower plant over the control wires.

A new concrete dam was built on the South Arkansas and a 20-ft. earth dam constructed on Fooses Creek to provide storage for peak capacity. Forebay level indicators for the two plants were provided at plant No. 2 so that the operators can maintain storage conditions for the most efficient operation. After installing the new unit a program of penstock changes was carried out. Studies indicated that a slightly larger size of penstock could be profitably installed and electrically welded pipe was used because of the reduced losses. The capacity of this plant was increased from 440 kw. before any work was done to 940 kw. in 1932, or an increase of 500 kw., of which 290 can be attributed to the replacement of the machine and increase of head at the dam and 210 attributed to the replacement of the penstock.

Fig. 1—The Salida Alamosa system of the Public Service Company of Colorado

Investment per kilowatt actually reduced by the changes

The results of the modernization program are best shown in the accompanying charts. In Fig. 2 the schedule of the work done and the plant's capacity is shown for each year. The increase of plant capacity is quite evident following each job. Fig. 3 indicates the progressive improvement in efficiency and capacity as various replacements and changes were made. The financial aspects of the modernization program are well illustrated in Figs. 4 and 5, which show the total net plant investment over the corresponding period of years expressed as per cent and also as investment per kilowatt of capacity. While the net investment has been increased, it is also shown that the capacity has increased so that the net investment per kilowatt has actually decreased, which is a desirable feaure on any system.

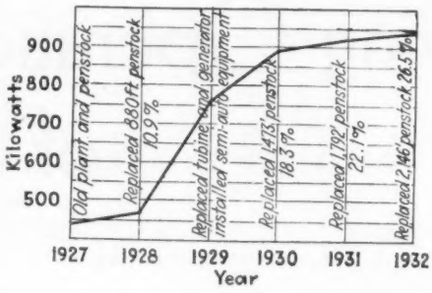


Fig. 2—Schedule of replacement at the Upper Salida plant and the capacity increases following these changes

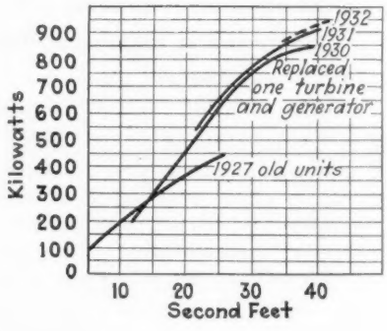


Fig. 3—Capacity of the Upper Salida hydro plant showing the increased efficiency resulting from modernization work

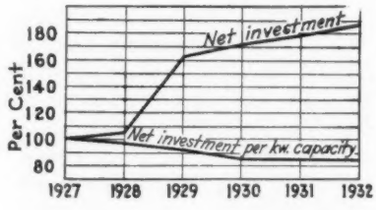


Fig. 4—Investment per kilowatt in the Upper Salida plant reduced during the period of rehabilitation

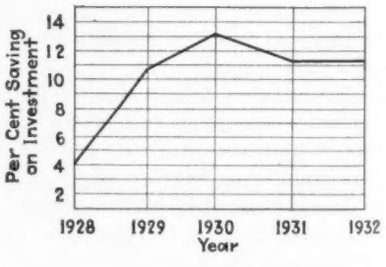


Fig. 5—Savings made in operating costs of the Upper Salida plant

This curve does not include any credit for increase in system capacity.

Money spent at this plant has resulted in improved working conditions, increased plant capacity and generation and the reliability of service and physical conditions of the property have been brought up to a standard consistent with present-day practice. This type of work has proved to be a very efficient way of protecting the investment in old hydro plants and obtaining power at reasonable costs without adding to present-day unemployment troubles.

Operators were moved from the upper plant to the lower plant and put on an eight-hour shift after proper housing facilities were added. This was necessary because the plant is high in the mountains, remote from any town, and it has been found desirable to have men available on such locations. The extra men now do much-needed maintenance work at both plants. Thus operators have been kept on the payroll under improved working conditions and without impairing the net savings which have resulted from the modernization program.

Men of the Industry

Mathews New Vice-President of Middle West Utilities

George C. Mathews, chief examiner of the Wisconsin Public Service Commission, has tendered his resignation to that body in order to become a vice-president of the Middle West Utilities Company. Mr. Mathews has been a member of the commission for more than 22 years. During the greater portion of that time he was in charge of the statistical, rate and accounting departments, and from 1925 to the present time he has been in charge of the blue sky division. Mr. Mathews is familiar with the economics of the public utility industry and is a recognized authority on utility rates.

▼

ARTHUR W. ALTHOUSE, for the past two years Alhambra district manager of the Southern California Edison Company, Ltd., has been appointed assistant division manager, Pasadena division.

•

HARRY H. BODGE, formerly merchandising manager of the Narragansett Electric Company, Providence, R. I., and at one time on the power sales engineering staff of the New England Power Engineering & Service Company, Boston, Mass., has been transferred to the Fall River Electric Light Company as power sales engineer.

•

MILTON H. FRANK, assistant to the vice-president of the Wisconsin Power & Light Company, has been appointed division manager of that utility with headquarters at Beloit. Mr. Frank has been identified with Wisconsin Power & Light and its predecessor, the Eastern Wisconsin Electric Company, since 1918, for the past three years holding the position of assistant to the vice-president. A graduate of Purdue University, he was connected early in his career with the Elkhart Hydro-Electric Development, Elkhart, Ind.; with the Indiana Michigan Electric Company and with the Galesburg Railway, Light & Power Company.

•

LOUIS K. COMSTOCK chairman of the board of L. K. Comstock & Company, electrical contractors, New York, has been elected president of the Merchants' Association of New York. Mr. Comstock, who had been vice-president of the association since 1928, is one of New York's best-known electrical contractors. An electrical engineer by profession, he was at one time superintendent of construction for the Western Electric Company. Later he was associated with the George A. Fuller Company before establishing the Comstock company, of which he has been the head since its organization in 1904.

•

WILLIAM H. TAYLOR, president of the Philadelphia Electric Company, has been elected for a five-year term to the board of trustees of Stevens Institute of Technology.

•

RAYMOND A. HOPKINS and LEWIS P. GOVE, formerly with the Stone & Webster Engineering Corporation, Boston, have established a consulting electrical and mechanical practice at Waltham, Mass., under the firm name of Hopkins & Gove.

•

RALPH G. KENNISON, formerly division engineer Central Maine Power Company, has been appointed assistant to F. W. Eaton, operating engineer of the system, with headquarters at Augusta.

•

EDWARD B. SILVERMAN, formerly with Clyde R. Place, consulting engineer, New York, has established a private consulting engineering practice with headquarters in New York. Mr. Silverman was responsible for the design of the electrical systems at Radio City Music Hall.

•

PAUL H. DEMING has been elected president and chairman of the board of Copeland Products, Inc., Detroit, succeeding William R. Wilson, resigned. E. W. Watwood was elected vice-president and Carleton S. Smith secretary and treasurer.

•

WILLIAM H. MUNRO of Peterboro, Ont., who for the past 29 years has been actively engaged in public utility work in many parts of the world, has been appointed general manager of the Ottawa (Ont.) Electric Company and the Ottawa Gas Company. Mr. Munro succeeds Col. D. R. Street, who has resigned to become director of public relations. Mr. Munro, for six years, was with the Vickers Company, England, on water-power work in various parts of the world.

•

CLARENCE H. NICHOLS, vice-president and general manager of the Federal Light & Traction Company, has been elected president of the New Brunswick Power Company at St. John, N. B., succeeding Edwin N. Sanderson, president of the Federal Light & Traction Company for many years and president of the New Brunswick company for the past eight years. William P. Southard was elected vice-president and general manager of the New Brunswick company to succeed Albert E. Reynolds, who is to take another position in the Federal Light & Traction service. Mr. Southard was formerly vice-president and general manager of the Trinidad Electric Transmission, Light & Traction Company, Trinidad, Colo.

•

HARRY REID, formerly president of the National Electric Power Company and the National Public Service Corporation, has organized Harry Reid & Company, Inc., with offices in New York. The new company will engage in the operation, engineering and supervision of public utility companies and will furnish reports and plans on construction, rates, taxes, recapitalization and reorganization. In this new venture Mr. Reid is associated with Alan E. Burns, Edward C. Isele, David W. Jones and Ralph C. Roe.

•

DAVID E. LILIENTHAL, member of the Wisconsin Public Service Commission, has been nominated by President Roosevelt as one of the members of the Tennessee Valley Authority. Mr. Lilienthal, who has been a prominent figure in the field of public utility regulation, was appointed to the commission in 1931. For a time he was secretary of the committee on public utility law of the American Bar Association and for five years lectured at Northwestern University on public utility law. Last week the Senate confirmed his nomination.

▼

OBITUARY

JOHN B. CONANT, formerly manager of the Dallas, Tex., office of Stone & Webster, died at Somerville, Mass., June 2. He was born at Charlestown, Mass., 58 years ago and was graduated from the Massachusetts Institute of Technology in 1900, joining Stone & Webster immediately. His Dallas service occupied eight years. Recently he had been engaged in manufacturing.

•

WILLIAM J. CLARK, vice-president of the Westchester Lighting Company for thirty-one years, died June 4 at the Mount Vernon Hospital, of a heart ailment, at the age of 81. A native of Bath, Me., Mr. Clark before becoming connected with the Westchester Lighting Company had been general manager of the fuel and appliance department of the Consolidated Gas Company of New York City.

•

HARRY R. ELLIS, who was connected with the electrical industry as general manager and treasurer of the Central Indiana Power Company some few years ago, died recently in Indianapolis following a heart attack. Mr. Ellis was

auditor of the Terre Haute, Indianapolis & Eastern Traction Company prior to his connection with the Central Indiana company.

•

HOMER GANT, manager of the Ohio Power Company at Van Wert, died recently in his fiftieth year. Mr. Gant was formerly associated with the Marion Light & Heating Company.

•

LEON H. FRANK, vice-president of the Bull Dog Electric Products Company, Detroit, Mich., died suddenly May 28 at Charleston, S. C., while motoring back to Detroit after having spent the winter in Florida. Mr. Frank had been active in the electrical jobbing and contracting field for a number of years.

•

CHARLES C. PEIRCE, a pioneer in steam railroad electrification, and for 39 years connected with the General Electric Company, died May 27 at his home in Medfield, Mass., after a long illness. He entered the service of the Edison General Electric Company in 1890 and when this company was merged with the Thomson-Houston Company two years later he became district manager of the railroad department of the new General Electric Company, and in this capacity electrified the Nantasket branch of the New York, New Haven & Hartford Railroad. He retired two years ago.

•

C. W. HUTTON, who participated in the early development of high-voltage transmission in California, first with the Pacific Gas & Electric Company and later with the Great Western Power Company, died recently. Later in his career Mr. Hutton engaged in private business and at the time of his death he was president and manager of Electrical Facilities, Inc. He was a fellow of the American Institute of Electrical Engineers.

•

EDWARD F. MILLER, head of the department of mechanical engineering of the Massachusetts Institute of Technology since 1911 and a member of the faculty for 47 years, died at his home in Newton Center, Mass., June 12 at the age of 67. Professor Miller had been selected to serve on many boards and commissions appointed by the state for investigation and regulation of engineering matters. He was an authority on problems of smoke abatement and his extensive knowledge of steam boilers led to his serving as expert in many legal cases. In the course of his engineering career he was active in the affairs of the American Society of Mechanical Engineers, and was a member of the American Society of Civil Engineers, Boston Society of Civil Engineers and the American Society of Refrigerating Engineers.

New Equipment Available

Mercury Switch Refractory Protected

A mercury switch which is refractory protected so as to confine the arc and to obtain long life with dependability has been announced by the Westinghouse Electric & Manufacturing Company. Made with nominal ratings from 3 to 50 amp., it comprises a new line of single-pole, single-throw switches which may be operated in either a.c. or d.c. circuits.

The contact is made by an impact between two pools of mercury within a refractory chamber encased in heavy glass walls. Instead of flowing slowly together, the mercury from one pool drops to meet the other with a sudden visible "jump." An atmosphere of inert gas within the chamber keeps the mercury chemically pure and prevents the loss of fluidity that causes it to become gummy and slow flowing. The gas also dissipates the heat of the arc.

▼

Tree Wire Guards

Constructed of two types of bakelite fabric and combining high dielectric strength with resistance to abrasion a tree wire guard has been announced by the Spaulding Fiber Company, Tonawanda, N. Y. It has a flexible bakelized curtain to inclose the wire with several turns, for electrical protection. The remainder of the guard consists of a hard, tough bakelite shell, weatherproof and resistant to abrasion. The shell completely incloses the fabric-wrapped wire and possesses a constant gripping action that maintains tightness of the convolutions and prevents longitudinal displacement.

▼

IMPORTANT CHANGES in the design of rotating cam limit switches for use with automatic feeder-catcher table control systems has been announced by Cutler-Hammer, Inc., Milwaukee, Wis. To meet the need for greater precision on tilt table drives, the new design has split cams arranged in pairs to give any adjustment between 4 to 8 deg. on the shortest cam and 180 to 360 deg. on the longest cam, without removing or cutting the cam.

•

A LINE OF fractional-horsepower gearmotors with the characteristics and construction of the latest designs of general purpose motors has been developed by the General Electric Company. They combine the desirable features of light weight, efficient high-speed motor drive with a simple compact reduction gear to give almost any desired speed at the output shaft, and are available in two types, both in ratings from one-sixth to three-quarter horsepower inclusive, the concentric shaft type with speeds from 500 to 98 r.p.m. and the right-angle shaft type with speeds from 200 down to 11 r.p.m.

▼

Starting Switch for Fractional-Horsepower Motor

To provide complete protection against stalled-rotor current and injurious overload conditions a small, hand-operated starting switch has been developed by the General Electric Company for use with either single-phase a.c. or d.c. fractional-horsepower motors. The a.c. switch is available in single- and double-pole forms. The new switch, designated as CR1061, affords the following features: Complete overload protection, a positive snap-action mechanism which is trip-free on overload, a sturdy and compact construction and adaptability for mounting in purchasers' inclosures. All molded parts are made from "Textolite" and the large contact tips are pure silver. The metal parts will resist corrosion. The switch has been tested and listed by the Underwriters' Laboratories.

▼

Steel-Inclosed Cubicles

Standardized 7.5-kv. steel-inclosed cubicles which can be assembled in any desired number of units have been announced by the Delta-Star Electric Company, Chicago. The manually, solenoid- or motor-operated oil circuit breakers are of trip-free design. The operating mechanism interlocks with the hinged door of the disconnecting switch compartment. The bus is located in the top of the compartment, which is provided with removable end covers to permit ready connection to future units.

▼

IN CONNECTION WITH AUTOMATIC CONTROL of motor-driven pumps the Electric Controller & Manufacturing Company, Cleveland, Ohio, has announced an EC&M altitude regulator. The regulator is claimed to be extremely sensitive in operation, being so designed that it is possible to obtain very close regulation of water and liquid levels. The high and low limit contacts can be set a minimum distance apart of 2 per cent of the scale reading up to a maximum of 100 per cent of the scale reading.